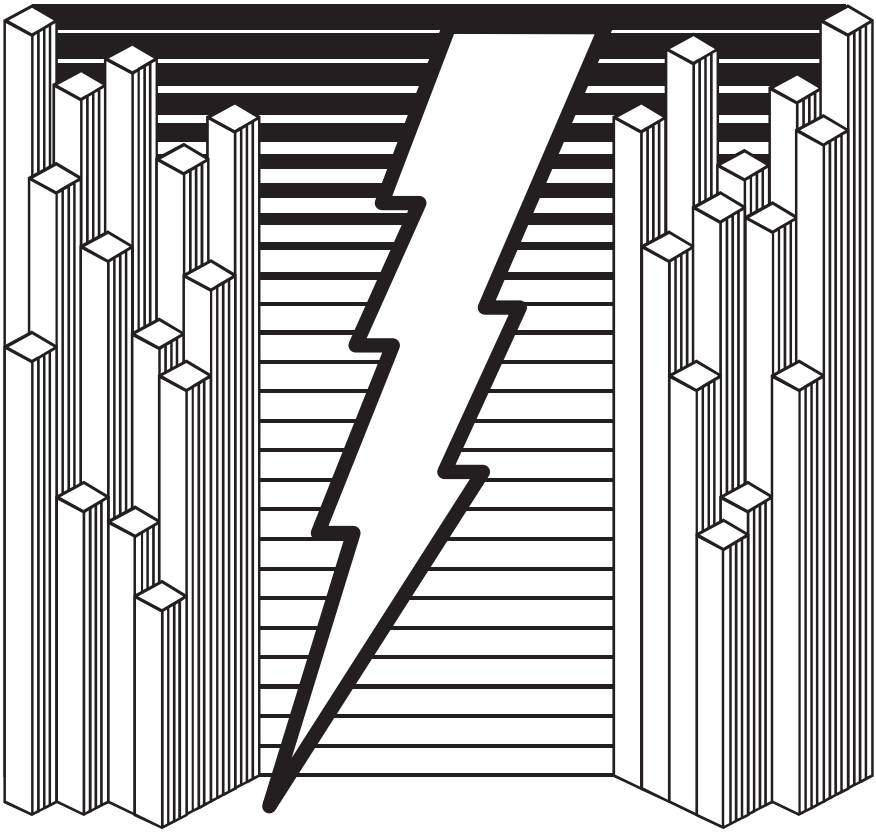
brain boxes



Opto DIO

4.0 EDITION Mar 1995

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FULL 36 MONTHS GUARANTEE.

BRAIN BOXES guarantee your interface card for a full 36 months from purchase, parts and labour, provided it has been used in the specified manner. In the unlikely event of failure return your interface card to BRAIN BOXES or to your Dealer, with proof of purchase, who will determine whether to repair or replace this product with an equivalent unit.

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Opto DIO48, Opto DIO16, Opto OUT48, Opto OUT24 and Opto IN24 are designed, manufactured and supported by

BRAIN BOXES.

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Thank You For Buying the Optically Isolated Input Output Interface!

We proudly present a range of optically isolated digital input output cards.

OPTO DIO48 provides 24 high voltage, high current outputs lines and 24 input lines all with +/-2500 Volts optical isolation.

OPTO DIO16 provides 8 high voltage, high current outputs lines and 8 input lines all with +/-2500 Volts optical isolation.

OPTO OUT48 gives the user with 48 high voltage, high current outputs lines with +/-2500 Volts optical isolation.

OPTO OUT24 gives the user with 24 high voltage, high current outputs lines with +/-2500 Volts optical isolation.

OPTO IN24 gives the user with 24 input lines with +/-2500 Volts optical isolation.

The optically isolated outputs are high voltage, high current outputs lines, with +/-2500 Volts optical isolation. Fast TTL buffers, opto isolators and drivers allow a maximum throughput of 150kHz. The cards may be fitted with source drivers or with sink drivers. The on chip current limiting resistors and output transient suppression diodes have been augmented by on board higher duty suppression diodes and pull down resistors so ensuring long term use in an industrial environment.

Cards with these outputs require an external, user supplied, power input to supply the opto isolators and the i/o drivers. On board regulation allows the use of unregulated supplies in the range 17.5-35 Volts. A minimum of 8VA current capability per 8 line source output package is needed. ie OUT24, DIO48

requires 25VA power supply, OUT48 requires 50VA power supply.

The optically isolated inputs are current limited and reverse polarity protected and provide +/-2500 Volts optical isolation. Fast TTL buffers, opto isolators and drivers allow a maximum throughput of 150kHz.

Most of the opto card range have an on board Watchdog Timer that can be used as a fail safe way to ensure the users program is running correctly and the PC has not crashed. (Not available on the DIO16)

The Opto DIO cards are the ideal for high output current control applications such as driving relays, solenoids, stepper motors, LED's or lamps requiring separate logic and load grounds.

A separate manual "The Interfacing Guide" with a disk full of worked examples in BASIC, PASCAL, C, Assembler and FORTRAN ensure that you are up and running with the card straight away!

Your card is designed and manufactured in England, and our policy is one of complete support to our dealers and direct to our users. It is designed 'in house' and is completely understood by our staff. Its great strength is the support we give it. Our intention is to supply the hardware, software and any technical information you may need to allow you to exercise complete control the card and i/o devices. After searching the manuals, do not hesitate to contact us on our HOTLINE number on Intro Page 2, if you need help.

We trust that if you adhere to the following procedures you will enjoy many years of useful service from your interface.

OPTO MANUAL.

The Layout Of This Manual.

This manual is a complete description of how to configure and install the Opto input output range of interface cards.

Information on register maps, programming and wiring up the is in a companion manual, "The Interfacing Guide".

Chapter 1, Outputs, Inputs, Watchdog & Power, describes the features common to many of the opto i/o cards. The topics covered are the external user supplied power supply, the output drivers types, the input circuit and the watch dog timer.

Chapter 2, Opto DIO48 Configuration, shows you how to configure the Opto DIO48 card ready for installation in an expansion slots of your computer, detailing the address DIP switches, card jumpers, i/o memory map and connector pinouts.

Chapters 3-6, shows you how to configure the Opto DIO16, OUT48, OUT24 and IN24 cards respectively.

Chapter 7, Installation In The PC, shows how the card can be installed an unused PC expansion slot.

The Index covers the complete contents of the manual.

Outline Contents.

Chapter 1. Outputs, Inputs, Watchdog & Power.
Chapter 2. Opto DIO48 Configuration.
Chapter 3. Opto DIO16 Configuration.
Chapter 4. Opto OUT48 Configuration.
Chapter 5. Opto OUT24 Configuration.
Chapter 6. Opto IN24 Configuration.
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CHAPTER 1
OPTO OUTPUTS, INPUTS, WATCHDOG, AND POWER.

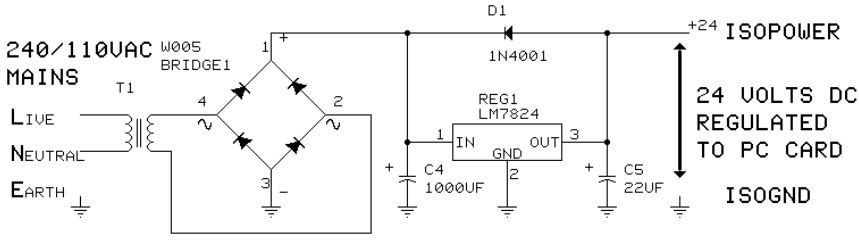
Introduction.

This chapter describes the features common to many of the opto i/o cards. The topics covered are the external user supplied power supply, the output drivers types, the input circuit and the watch dog timer.

Power Supply.

Those cards that have opto isolated outputs require an external power input to drive the isolators and the output driver chips. The external power input is a nominal 24 volts input put.

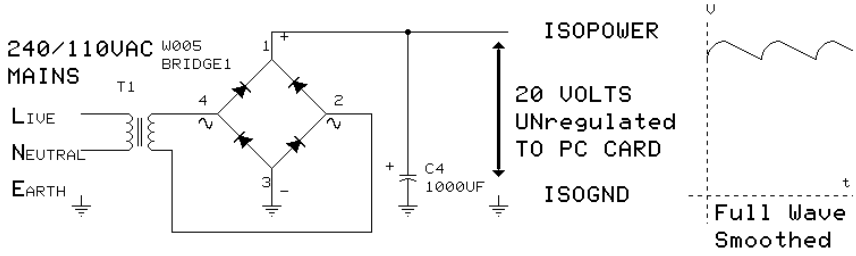
Figure 1-1. Regulated Power Supply.



Either a commercially available DC power supply or a home made one may be used. The supply can be regulated or un regulated. The opto cards have on board regulation and reverse connection protection. Suitable regulated and unregulated supply circuits are given below. The power supplies range 17.5 to 30 Volts maximum capable of supplying a minimum of 2 Amps at 25 Volts. ie 50 VA rating. (OUT48 4 Amp @ 25 Volt= 100VA)

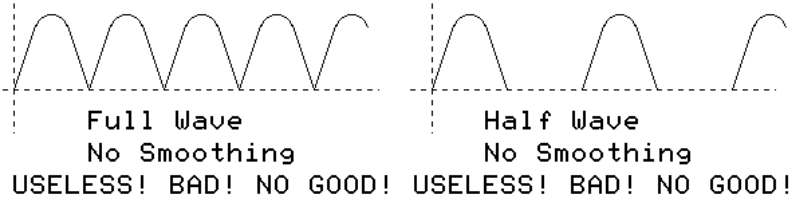
If an unregulated power supply is used ensure that it is rectified and has sufficient smoothing to kept it above the absolute minimum of 17 volts.

Figure 1-2. Unregulated Power Supply.



Unsuitable power supplies are those that provide only half wave rectification and those that are unsmoothed. Both these types fall below the minimum +17 Volts necessary to allow the on board regulation to work.

Figure 1-3. Useless Power Supply.



Output Driver Types.

Those opto isolated cards that have output lines, Opto DIO16, Opto DIO48, Opto OUT24 and Opto OUT48 can be configured to use one of two types of high voltage drive chips. These types are known as sink drivers and source drivers. The sink driver chips chips are of type ULN2804 and the source driver chips are of type UDN 2984 chips.

Which type of chip is fitted on the opto card is determined by the part number used to order the card. The cards are supplied with the SOURCE drivers UDN2984 fitted as standard, unless the user specified SINK at the time of ordering. The card can be easily changed between sink and source specification by exchanging certain chips and setting a pair of jumpers.

The difference between these two types of driver, their output current capabilities, their power on reset condition and optional inverting configuration is explained below.

Sink And Source Explained.

The output ports of the card are optically isolated from the rest of the PC so that wiring defects or accidental connections to high voltage or high current devices do not damage the PC. In addition the outputs are via high voltage, high current driver chips. The lines of these driver chips are connected by the user to a load. As the users programs sets the output port lines high and low the output driver chips attempt to pull the loads to a high and low voltage.

When current flows out of the driver output terminal and into the load, the device is said to "source" current. This is a source driver. Conversely current flows from a load into a "sink" driver.

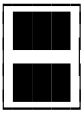
Source drivers can pull outputs both up and down. When the PC is powered off whilst the external power is ON the port lines are ON.

Sink drivers can only pull an output down to ground, they cannot pull an output up. When the PC is powered off whilst the external power is ON the port lines are ON.
With sink drivers the outputs only go high when the external circuit pulls them high. eg via a resistor attached to a positive voltage source.

Sink drivers can provide both source and sink functions. Sink drivers cannot provide source driver functions. However, they can cope with significantly higher current loads.

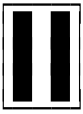
Figure 1-4. Driver Chip Select.

FACTORY SET



UDN2984 Source Drivers Selected

Optional 10k resistor networks installed



ULN2804 Sink Drivers Selected

Remove resistor networks

UDN2984 ULN2804 Driver Selection.

The card can be configured to use one of two types of high voltage drive chips ULN2804 or UDN 2984 chips.

The two jumper pins directly below and just to the left of the driver chips is used to made the selection. Note the OPTO DIO is supplied with the UDN2984 fitted as standard, the user may fit the ULN2804s themselves or order them factory fitted.

Source Driver Output Connection.

UDN2984 Drivers.

The UDN2984 chips are high voltage, high current SOURCE drivers, output voltage range 35 to 80 Volts, these could be directly replaced by UDN2981 drivers for output voltages in the range 5 to 50 Volts. Whilst the 2984/81 drivers have built in output transient suppression diodes, extra diodes are provided on board the Opto DIO cards for extra protection. The socketed 10k resistor networks RN14, 16 and 18 etc should be left installed.

The source driver output schematic is shown in Figure 1-5. Typical output connections are shown in Figure 1-6. Both pull down and pull up connection schemes work.

Figure 1-5. Source Driver Output Port Schematic.

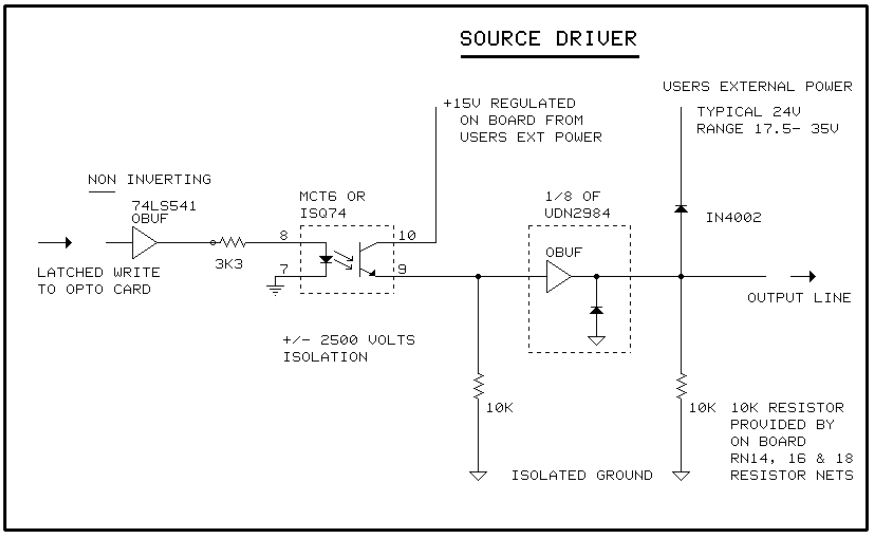
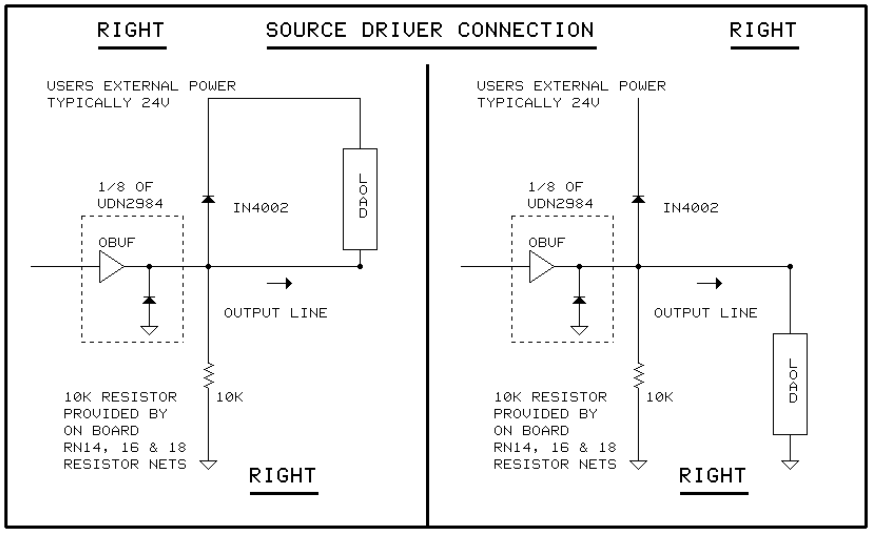


Figure 1-6. Source Driver Output Connections.



Source Driver Output Logical Levels.

The source cards are supplied with non inverting buffer chips, 74LS541, so that a logical one written to the output register drives the output high and a logical zero written to the output port drives the output low. Thus in this normal mode of operation the voltage level of the output line follows the logic level in the output register.

The source cards can be fitted with inverting buffer chips, 74LS540, so that a logical one written to the output register drives the output low and a logical zero written to the output port drives the output high. See Figure 1-7. Thus in this inverse mode of operation the voltage level of the output line does the opposite of the logic level in the output register.

Note since the sink driver chips are inverting and the source are not the non inverting buffer chips are must be changed when source and sink drivers are changed.

Figure 1-7. Logically Inverting The Source Output.

DRIVER	BUFFER USED	PORT DATA	PORT LINES	OPERATION
SOURCE	74LS541	0 = low	OFF = low	NORMAL
SOURCE	74LS541	1 =high	ON =high	NORMAL
SOURCE	74LS540 INVERTERS	0 = low	ON =high	INVERSE
SOURCE	74LS540 INVERTERS	1 =high	OFF = low	INVERSE

Note: By default Source driver use 74LS541 non inverting buffers, 74LS540 INVERTING buffers will invert the output signals.

Sink Driver Output Connection.

ULN2804 Drivers.

The ULN2804 chips are high voltage, high current NPN DARLINGTON open collector drivers, output voltage range to 50 Volts. Use ULN2824 chips for output up to 95 Volts. When changing from 2984 to 2804 drivers note than the 2804 are INVERTING drivers, thus to produce the same logical output

from a bit pattern written to the output port the 74LS541 chips would have to be replaced by the inverting 74LS540 chips. Remove the socketed 10k resistor networks.

Figure 1-8. Sink Driver Output Port Schematic.

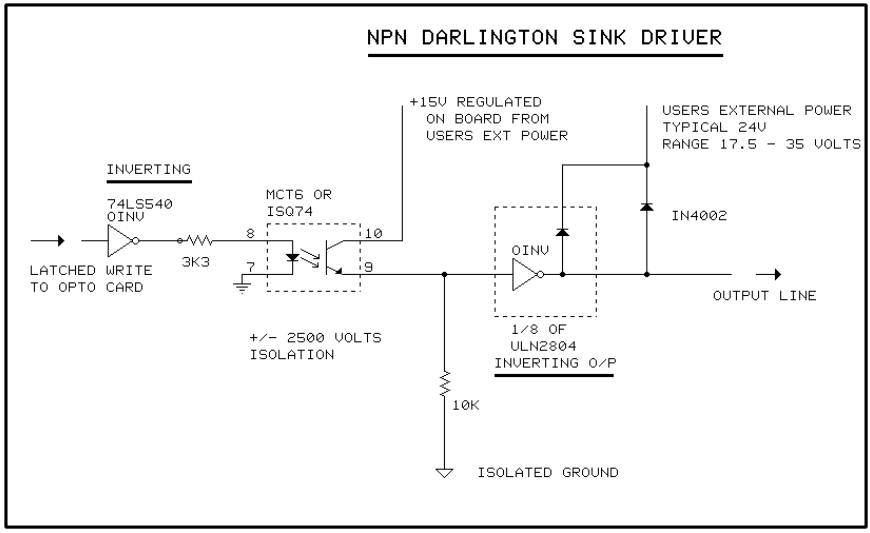
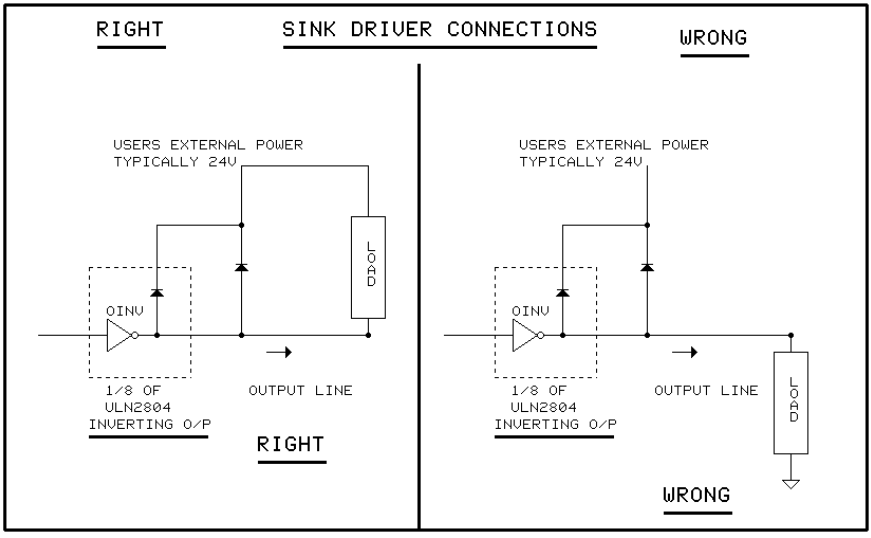


Figure 1-9. Sink Driver Output Connections.



The sink driver output schematic is shown in Figure 1-8. Typical output connections are shown in Figure 1-9. **Note only the pull down scheme works with sink drivers.**
The sink drivers can only pull down the output lines.

Sink Driver Output Logical Levels.

The sink cards are normally fitted with inverting buffer chips, 74LS540, so that a logical one written to the output register drives the output high and a logical zero written to the output port drives the output low. Thus in this normal mode of operation the voltage level of the output line follows the logic level in the output register.

The sink cards can be fitted with non inverting buffer chips, 74LS541, so that a logical one written to the output register drives the output low and a logical zero written to the output port drives the output high. See Figure 1-10. Thus in this inverse mode of operation the voltage level of the output line does the opposite of the logic level in the output register.

Note since the sink driver chips are inverting and the source are not the non inverting buffer chips are must be changed when source and sink drivers are changed.

Figure 1-10. Logically Inverting The Sink Output.

DRIVER	BUFFER USED	PORT DATA SETTING	PORT LINES	OPERATION
SINK	74LS540 INVERTERS	0 = low	OFF = low	NORMAL
SINK	74LS540 INVERTERS	1 =high	ON =high	NORMAL
SINK	74LS541	0 = low	ON =high	INVERSE
SINK	74LS541	1 =high	OFF = low	INVERSE

Note: By default Sink driver, since they are inverting drivers themselves, use 74LS540 inverting buffers to give a non inverting output. Using 74LS541 buffers will invert the output signals.

Power Off And Reset Output Levels.

Due to the difference in the nature of internal circuitry of the sink and source driver chips there are systematic differences in the power off and reset voltage levels of the output lines when using these two driver types.

Typically the the source drivers keep the output lines at zero when the PC is switched off, whilst the sink drivers allow the outputs to float to a high voltage level determined by the external circuit.

Figure 1-11. Sink Versus Source Outputs.

DRIVER	PC STATE	EXTERNAL POWER	BUFFER USED	PORT SETTING	PORT LINES
SOURCE	POWER OFF	ON	EITHER	N/A	OFF
SOURCE	POWER RESET	ON	EITHER	RESET =low	OFF
SOURCE	ON	ON	74LS541	0 =low	OFF
SOURCE	ON	ON	74LS541	1 =high	ON
SOURCE	ON	ON	74LS540 INV	0 =low	ON
SOURCE	ON	ON	74LS540 INV	1 =high	OFF
SINK	POWER OFF	ON	EITHER	N/A	ON
SINK	POWER RESET	ON	EITHER	RESET =low	OFF
SINK	ON	ON	74LS540 INV	0 =low	OFF
SINK	ON	ON	74LS540 INV	1 =high	ON
SINK	ON	ON	74LS541	0 =low	ON
SINK	ON	ON	74LS541	1 =high	OFF

Note: By default Source driver use 74LS541 non inverting buffers, 74LS540 INVERTING buffers will invert the output signals.
Note: By default Sink driver, since they are inverting drivers themselves, use 74LS540 inverting buffers to give a non inverting output. Using 74LS541 buffers will invert the output signals.

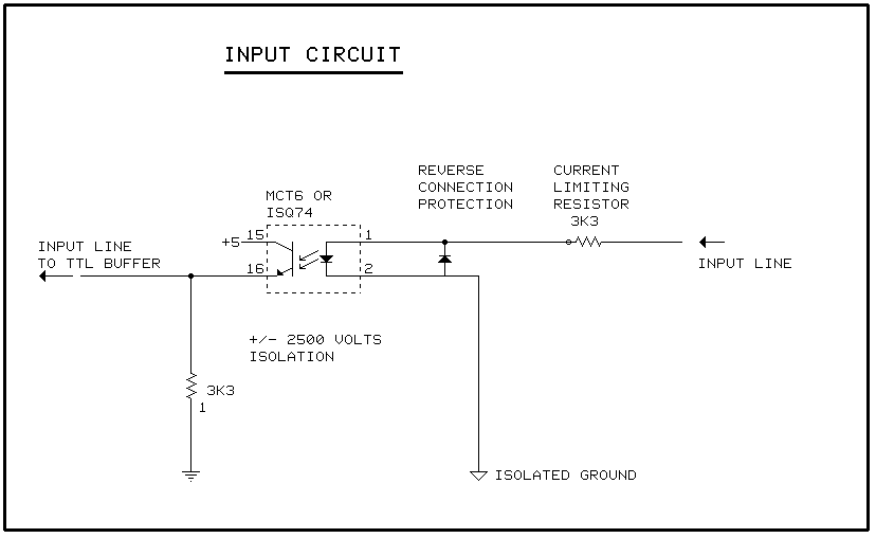
Safety First.

If the power off and power reset state of the output lines is critical to the safe operation of your circuit, examine Figure 1-11 and check the actual operation of the card when the external circuit is connected. Perform this check both with and without

the external isolated power supply applied.

Do not make any assumptions about the effects of changes made to the external circuit if the power off and reset conditions are critical to the safe operation of your system.

Figure 1-12. Input Port Schematic.



Input Port Schematic.

The input port schematic is given in Figure 1-12. The input port lines are reverse connection protected and current limited. Input voltages of 0.0 - 2.38 Volts read as input logic low, 0. Input voltages of 2.4 - 24.00 Volts read as input logic high, 1.

The inputs are current limited by a 3k3 Ohm resistor and are reverse connection protected by diodes.

The Watch Dog.

The watch dog is a failsafe method of ensuring that the user's program is still running correctly. On power up, the watch dog is disabled. If the user's program enables the watchdog, an

interrupt or reset signal is generated on timeout. Reading the watchdog register refreshes the timer, postponing timeout for 50 milliseconds. When the watch dog times out an timer expired output signal is set. On those cards that provide opto isolated outputs the watchdog timer expired output, in place of Port A line bit 0, is available on the 50 way edge connector.
The watch dog timer expired output is jumper selectable to one of four options.
Timer expired jumper selectable output signal options are:-

i) a constant high level voltage.
ii) a constant low level voltage.
iii) a goes high then returns low pulse.
iv) a goes low then returns high pulse.

The constant level pulses are suitable as enable lines for stepper motors or switches etc.
The goes high then returns low pulse is suitable for gating onto PC interrupt and reset lines. Note many PC reset lines are outputs only and so the opto cards watchdog pulse will not cause a PC reset on timeout.

The watch dog is enable by writes to the watchdog register. See Figure 1-13.

Figure 1-13. Watch Dog Enable Register.

WATCH DOG ENABLE REGISTER DEFAULT ADDR ARE 030B & 030F Hex
THIS IS A READ WRITE REGISTER

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
WRITE	DONT CARE			GATE PORT C2 BIT 3 TO IRQ	GATE PORT C2 BIT 0 TO IRQ	GATE JUMPER BUS TO IRQ	GATE JUMPER BUS TO RESET
READ	ALWAYS 0						

READ OF THIS REGISTER REFRESHES THE WATCH DOG TIMER
READ THIS AT LEAST ONCE EVERY 50 MILLI SECONDS TO PREVENT TIMOUT

Note OUT24, OUT48 and DIO16 BIT 3 and BIT 2 ALWAYS = ZERO!

Watch Dog Enable Register.

The watch dog enable register is an 8 bit read write register. Writing the bits enables, gates, various signals onto the PC expansion bus IRQ or RESET line. Thus allowing an interrupt or reset to be generated in the PC. On power up all the bits are cleared to zero. IE No signals are gated through to the PC bus. The bit map of the Watch Dog register is given below.
Bits 7-4 are always read back as zero, writing them high or low has no effect. For compatibility with future versions of this card bits 7-4 should always be written as 0.

Bit 0 when =1 the watch dog BUS jumper signal is gated to PC bus RESET line. This line causes a power on reset of the PC when driven high.
NOTE this line is an output only on many PC's and so cannot be used to reset the PC.

Bit 1 when =1 the watch dog BUS jumper signal is gated to the PC bus IRQ line as selected by the IRQ jumper block.

Bit 2 DIO48 and IN24 ONLY
when =1 the Port C2 bit 0 input signal is gated from the opto isolator to the IRQ selected by the IRQ jumper block. Low to high transitions generates a PC interrupt.
OUT24, OUT48 and DIO16 BIT 2 ALWAYS = ZERO.

Bit 3 DIO48 and IN24 ONLY
when =1 the Port C2 bit 3 input signal is gated from the opto isolator to the IRQ line selected by the IRQ jumper block. Low to high transition generates the PC interrupt.
OUT24, OUT48 and DIO16 BIT 3 ALWAYS = ZERO.

The IRQ handler should check, by reading the watchdog register, which interrupt is enabled and service the appropriate function, eg Watch dog timeout or transition of the Port C lines.

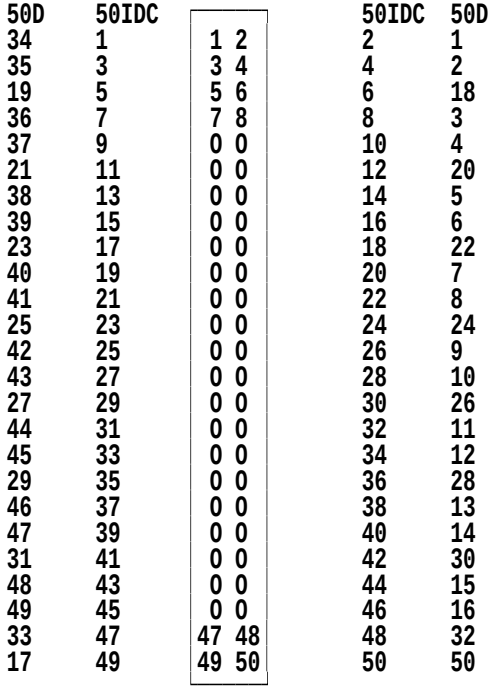
Watch Dog Time Out.

The watch dog times out after 50 milli seconds. The time out is prevented by a read of the watch dog register, this refreshes the 50 milli second timeout. Writes to the register do

not refresh the timeout. It is necessary to continuously perform a read of the watch dog register at least 20 times a second. The watch dog timer may be refreshed more frequently than this, in fact, as often as the user sees fit. From the end of the last refresh a 50 millisecond period may elapse before the watch dog times out. On time out, depending on how the watch dog options, PA10 output select jumpers and watch dog register enable bits are set, either output lines are set or software interrupts or PC reset are caused.

Generally, the watch dog is used as a fail safe method of ensuring that the users software is running correctly and that the PC has not crashed.

Figure 1-14. 50IDC To 50D Pin Outs.



50D	50IDC		50IDC	50D
34	1	1 2	2	1
35	3	3 4	4	2
19	5	5 6	6	18
36	7	7 8	8	3
37	9	0 0	10	4
21	11	0 0	12	20
38	13	0 0	14	5
39	15	0 0	16	6
23	17	0 0	18	22
40	19	0 0	20	7
41	21	0 0	22	8
25	23	0 0	24	24
42	25	0 0	26	9
43	27	0 0	28	10
27	29	0 0	30	26
44	31	0 0	32	11
45	33	0 0	34	12
29	35	0 0	36	28
46	37	0 0	38	13
47	39	0 0	40	14
31	41	0 0	42	30
48	43	0 0	44	15
49	45	0 0	46	16
33	47	47 48	48	32
17	49	49 50	50	50

Connector Cross Reference.

Figure 1-14 is a cross reference of the 50 IDC connector to 50 way Female D connector pinouts. Though it may seem like an arbitrary mapping it is the most logical available as can be seen from an examination of the pcb tracks. The corresponding cross reference for the 50D to 50IDC is in Figure 1-15.

Figure 1-15. 50D To 50IDC Pin Outs.

50IDC	50D Row1	50D Row2				50D Row3	50IDC
2	1		1		34	34	1
6		18		18			
4	2		2		35	35	3
5		19		19			
8	3		3		36	36	7
12		20		20			
10	4		4		37	37	9
11		21		21			
14	5		5		38	38	13
18		22		22			
16	6		6		39	39	15
17		23		23			
20	7		7		40	40	19
24		24		24			
22	8		8		41	41	21
23		25		25			
26	9		9		42	42	25
30		26		26			
28	10		10		43	43	27
29		27		27			
32	11		11		44	44	31
36		28		28			
34	12		12		45	45	33
35		29		29			
38	13		13		46	46	37
42		30		30			
40	14		14		47	47	39
41		31		31			
44	15		15		48	48	43
48		32		32			
46	16		16		49	49	45
47		33		33			
49	17		17		50	50	50

CHAPTER 2
OPTO DIO48 CONFIGURATION.

Introduction.

Read Chapter 1 first. This chapter explains how to configure the Opto DIO48 card ready to install in a PC. Detailed instructions are given how to set the address select, the IRQ jumper block and the output driver select jumper block. The settings of the watch dog timer output are also explained.

The two thirds size Opto DIO48 card will fit into both long or short slots, in either 8 bit slots or the longer 16 bit slots.

Configuring The Opto DIO48 Card.

In the state it leaves our factory, Opto DIO48 card is ready to plug straight into an PC computer.

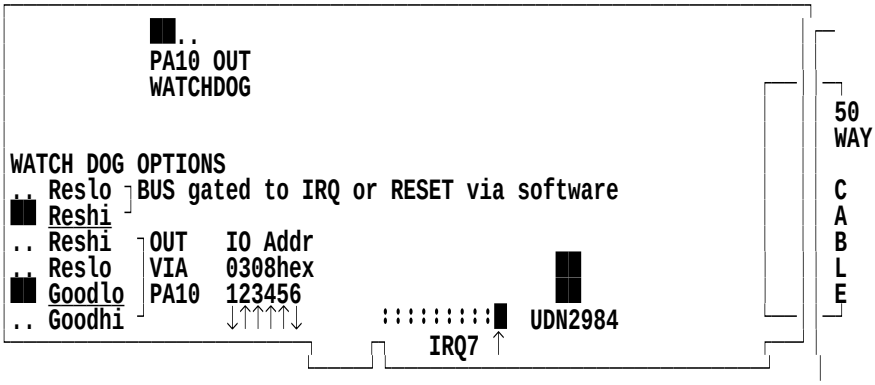
So, unless you have GOOD REASON, you do not need to alter its default setting.

However, due to the large variety of add-on cards that may be present in the PC, your Opto DIO48 card may need adjusting to suit your setup.

The layout of the Opto DIO48 card is given in Figure 2-1. The default settings are i/o address 0308Hex, IRQ 7 selected but not enabled, WATCHDOG VIA PA10 disabled- the PA10 line is output- and the WATCH DOG OUTPUT OPTIONS, GOODLO output jumpered to OUT, RESHI output jumpered to BUS. The source cards have the UDN2984 chips installed and the sink cards have ULN2803 chips installed.

The Opto DIO48 requires an external power input to power the output drivers and the isolated side of the opto couplers. On card power regulation allows the use of external un-regulated power source, input range 17.5 - 35 Volts. The power supply input is reverse polarity protected.

Figure 2-1. Opto DIO48 Card Layout.

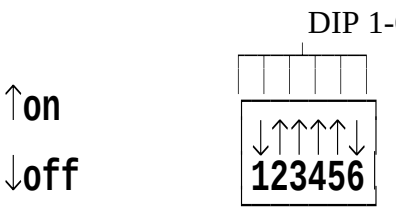


Setting The Opto DIO48 I/O Address.

By referring to the Opto DIO48 card locate the 6 way DIP switch at the middle left hand corner of the card.

The factory set address, 0308H, is set as shown in Figure 2-2. DIP switches control the base address selected, switches 1-6 correspond to the A3-A8 address lines. The Opto DIO48 card can reside at one of 64 base addresses on an 8 byte boundary within the range 0200H-03F8H.
The software controlling the card must know its i/o address.

Figure 2-2. Opto DIO48 Factory Set DIP Switches.



Opto DIO48 Factory Set Default Address= 0308 Hex, 776 Decimal

The i/o addresses that are likely to be good are in Figure 2-3, addresses to avoid are given in Figure 2-4. Only if the

particular card is present need the relevant address be avoided.

Figure 2-3. I/O Addresses To Avoid.

```
I/O ADDRESS       NORMAL USE.
0201H-      0201H Game Control Adapter
0278H-      027FH *** Second Printer Port Adapter
02E1H             *** PC ELITE IEEE Card.
02E1H             IBM/ National Instruments IEEE card.
02F8H-      02FFH *** COM2 Serial Port
0300H-      031FH NE2000 Network Card.
0300H-      030FH 3COM Network Card.
0300H-      0307H *** PC Proto card
0300H-      0303H *** PC IEEE Card
0300H-      0303H *** PC DIO24 Card
0308H-      030BH *** PC OPTO OUT24 Card
0308H-      030FH *** Opto OUT48, Opto DIO16, OptoDIO48 & DIO48 Cards
030CH-      030FH *** PC OPTO IN24 Card
0310H-      031FH *** PC Timer-DIO Card
0340H-      0360H *** PC DIO192 Card
0378H-      037FH *** Printer Port Adapter
03B0H-      03DFH VGA /SVGA card
03F0H-      03F7H Floppy Disk Drive Drive.
03F8H-      03FFH *** COM1 Serial Port.
*** These cards available from us.
```

Figure 2-4. Likely I/O Address.

```
I/O ADDRESS       NORMAL USE.
0204H-      0277H Unused.
0280H-      02BFH Unused.
02C8H-      02DFH Unused.
02E4H-      02F7H Unused.
0300H-      031FH Unused.
0330H-      035FH Unused.
0380H-      03AFH Unused Usually.
03E0H-      03EFH Unused.
```

Using More Than One Opto DIO48 Board.

Several Opto DIO cards can be installed at the same time, allowing each card to control its own set of i/o lines.

The golden rule is:- Ensure that each card is set to a different i/o address and the ranges do not overlap!

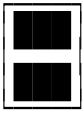
Figure 2-5. Opto DIO48 Base Addresses.

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6		Base Address Of Card	
Off	Off	Off	Off	Off	Off	↓↓↓↓↓↓	03F8 Hex	1016 Dec
On	Off	Off	Off	Off	Off	↑↓↓↓↓↓	03F0 Hex	1008 Dec
Off	On	Off	Off	Off	Off	↓↑↓↓↓↓	03E8 Hex	1000 Dec
On	On	Off	Off	Off	Off	↑↑↓↓↓↓	03E0 Hex	992 Dec
Off	Off	On	Off	Off	Off	↓↓↑↓↓↓	03D8 Hex	984 Dec
On	Off	On	Off	Off	Off	↑↓↑↓↓↓	03D0 Hex	976 Dec
Off	On	On	Off	Off	Off	↓↑↑↓↓↓	03C8 Hex	968 Dec
On	On	On	Off	Off	Off	↑↑↑↓↓↓	03C0 Hex	960 Dec
Off	Off	Off	On	Off	Off	↓↓↓↑↓↓	03B8 Hex	952 Dec
On	Off	Off	On	Off	Off	↑↓↓↑↓↓	03B0 Hex	944 Dec
Off	On	Off	On	Off	Off	↓↑↓↑↓↓	03A8 Hex	936 Dec
On	On	Off	On	Off	Off	↑↑↓↑↓↓	03A0 Hex	928 Dec
Off	Off	On	On	Off	Off	↓↓↑↑↓↓	0398 Hex	920 Dec
On	Off	On	On	Off	Off	↑↓↑↑↓↓	0390 Hex	912 Dec
Off	On	On	On	Off	Off	↓↑↑↑↓↓	0388 Hex	904 Dec
On	On	On	On	Off	Off	↑↑↑↑↓↓	0380 Hex	896 Dec
Off	Off	Off	Off	On	Off	↓↓↓↓↑↓	0378 Hex	888 Dec
On	Off	Off	Off	On	Off	↑↓↓↓↑↓	0370 Hex	880 Dec
Off	On	Off	Off	On	Off	↓↑↓↓↑↓	0368 Hex	872 Dec
On	On	Off	Off	On	Off	↑↑↓↓↑↓	0360 Hex	864 Dec
Off	Off	On	Off	On	Off	↓↓↑↓↑↓	0358 Hex	856 Dec
On	Off	On	Off	On	Off	↑↓↑↓↑↓	0350 Hex	848 Dec
Off	On	On	Off	On	Off	↓↑↑↓↑↓	0348 Hex	840 Dec
On	On	On	Off	On	Off	↑↑↑↓↑↓	0340 Hex	832 Dec
Off	Off	Off	On	On	Off	↓↓↓↑↑↓	0338 Hex	824 Dec
On	Off	Off	On	On	Off	↑↓↓↑↑↓	0330 Hex	816 Dec
Off	On	Off	On	On	Off	↓↑↓↑↑↓	0328 Hex	808 Dec
On	On	Off	On	On	Off	↑↑↓↑↑↓	0320 Hex	800 Dec
Off	Off	On	On	On	Off	↓↓↑↑↑↓	0318 Hex	792 Dec
On	Off	On	On	On	Off	↑↓↑↑↑↓	0310 Hex	784 Dec
Off	On	On	On	On	Off	↓↑↑↑↑↓	0308 Hex	776 Deflt
On	On	On	On	On	Off	↑↑↑↑↑↓	0300 Hex	768 Dec
Off	Off	Off	Off	Off	On	↓↓↓↓↓↑	02F8 Hex	760 Dec
On	Off	Off	Off	Off	On	↑↓↓↓↓↑	02F0 Hex	752 Dec
Off	On	Off	Off	Off	On	↓↑↓↓↓↑	02E8 Hex	744 Dec
On	On	Off	Off	Off	On	↑↑↓↓↓↑	02E0 Hex	736 Dec

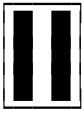
Off	Off	On	Off	Off	On	↓↓↑↓↓↑	02D8 Hex	728 Dec
On	Off	On	Off	Off	On	↑↓↑↓↓↑	02D0 Hex	720 Dec
Off	On	On	Off	Off	On	↓↑↑↓↓↑	02C8 Hex	712 Dec
On	On	On	Off	Off	On	↑↑↑↓↓↑	02C0 Hex	704 Dec
Off	Off	Off	On	Off	On	↓↓↓↑↓↑	02B8 Hex	696 Dec
On	Off	Off	On	Off	On	↑↓↓↑↓↑	02B0 Hex	688 Dec
Off	On	Off	On	Off	On	↓↑↓↑↓↑	02A8 Hex	680 Dec
On	On	Off	On	Off	On	↑↑↓↑↓↑	02A0 Hex	672 Dec
Off	Off	On	On	Off	On	↓↓↑↑↓↑	0298 Hex	664 Dec
On	Off	On	On	Off	On	↑↓↑↑↓↑	0290 Hex	656 Dec
Off	On	On	On	Off	On	↓↑↑↑↓↑	0288 Hex	648 Dec
On	On	On	On	Off	On	↑↑↑↑↓↑	0280 Hex	640 Dec
Off	Off	Off	Off	On	On	↓↓↓↓↑↑	0278 Hex	632 Dec
On	Off	Off	Off	On	On	↑↓↓↓↑↑	0270 Hex	624 Dec
Off	On	Off	Off	On	On	↓↑↓↓↑↑	0268 Hex	616 Dec
On	On	Off	Off	On	On	↑↑↓↓↑↑	0260 Hex	608 Dec
Off	Off	On	Off	On	On	↓↓↑↓↑↑	0258 Hex	600 Dec
On	Off	On	Off	On	On	↑↓↑↓↑↑	0250 Hex	592 Dec
Off	On	On	Off	On	On	↓↑↑↓↑↑	0248 Hex	584 Dec
On	On	On	Off	On	On	↑↑↑↓↑↑	0240 Hex	576 Dec
Off	Off	Off	On	On	On	↓↓↓↑↑↑	0238 Hex	568 Dec
On	Off	Off	On	On	On	↑↓↓↑↑↑	0230 Hex	560 Dec
Off	On	Off	On	On	On	↓↑↓↑↑↑	0228 Hex	552 Dec
On	On	Off	On	On	On	↑↑↓↑↑↑	0220 Hex	544 Dec
Off	Off	On	On	On	On	↓↓↑↑↑↑	0218 Hex	536 Dec
On	Off	On	On	On	On	↑↓↑↑↑↑	0210 Hex	528 Dec
Off	On	On	On	On	On	↓↑↑↑↑↑	0208 Hex	520 Dec
On	On	On	On	On	On	↑↑↑↑↑↑	0200 Hex	512 Dec

Figure 2-6. Driver Chip Select.

FACTORY SET



UDN2984 Source Drivers Selected — RN14, 16 and 18 installed 10K resistor networks



ULN2804 Sink Drivers Selected — Remove RN14, 16 and 18

UDN2984 ULN2804 Driver Selection.

The card can be configured to use one of two types of high voltage drive chips ULN2804 or UDN 2984 chips. Chapter 1 explains the difference and function of these two driver types.

The two jumper pins directly below and just to the left of the driver chips is used to made the selection.

Source Driver Output Connection.

UDN2984 Drivers.

The UDN2984 chips are high voltage, high current SOURCE drivers, output voltage range 35 to 80 Volts, these could be directly replaced by UDN2981 drivers for output voltages in the range 5 to 50 Volts. Whilst the 2984/81 drivers have built in output transient suppression diodes, extra diodes are provided on card the Opto DIO48 card for extra protection. The socketed 10k resistor networks RN14, 16 and 18 should be left installed.

For normal operation, with UDN2984 chips installed, sockets U30, U28 and U26 contain non inverting buffers chips 74LS541.

For inverse operation, inverting buffers chips 74LS540 should be installed in sockets U30, U28 and U26.

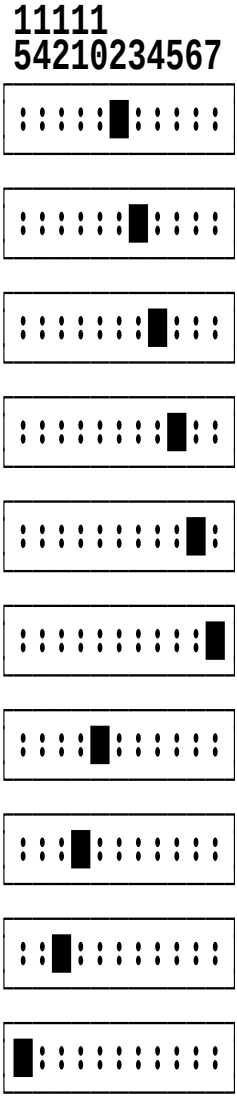
Sink Driver Output Connection.

ULN2804 Drivers.

The ULN2804 chips are high voltage, high current NPN DARLINGTON drivers, output voltage range to 50 Volts, these could be directly replaced by ULN2824 chips for output voltages up to 95 Volts. The 2804 have open collector outputs. When changing from 2984 to 2804 drivers note than the 2804 are INVERTING drivers, thus to produce the same logical output from a bit pattern written to the output port the 74LS541 chips would have to be replaced by the inverting 74LS540 chips. Remove the socketed 10k resistor networks RN14, 16 & 18.

For inverse operation, then the non inverting buffers chips 74LS541 should be installed in sockets U30, U28 and U26.

Figure 2-7. The IRQ Jumper Block.


11111
54210234567
NORMAL USE OF INTERRUPT.
IRQ2 EGA/VGA GRAPHICS CARD, Usually Free
Used by only very few graphics cards.
IRQ3 COM 2- COM 8.
IRQ4 COM 1.
IRQ5 PRINTER PORT#2 OK for DOS & Windows
Avoid for OS/2, Windows NT & Novell
IRQ6 FLOPPY DISK DRIVE, AVOID!.
IRQ7 PRINTER PORT#1 OK for DOS & Windows
Avoid for OS/2, Windows NT & Novell
IRQ10 Usually Free
IRQ11 Usually Free
IRQ12 POINTING DEVICE, Usually Free
Free when mouse is on a COM port.
IRQ15 Usually Free

Note: IRQ0, 1 & 8, timer-keyboard-clock, not on expansion bus.
IRQ9, best left unexplained, is not on expansion bus.
IRQ13, maths coprocessor int, is not on the expansion bus.
IRQ14, Hard Disk drive.

Interrupt Selection.

The Opto DIO48 card can produce interrupts from low to high transitions on three signal lines, Watch Dog timeout, Port C2 input bit 0 and Port C2 input bit 3.

The IRQ must be ENABLED in software AND the IRQ jumper must both be set before any IRQ requests are generated. Thus IRQs can be enabled under program control to suit the changing needs of the application. The position of the jumper MUST match the IRQ level set in the software.

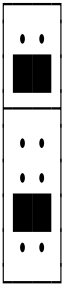
The IRQ enable bits in the watch dog register selects which Opto DIO48 signal generates the interrupt, the IRQ jumper block selects which PC interrupt line is asserted, and so which software interrupt service routine is called. Write your IRQ service routine to patch the appropriate software interrupt.

Watch Dog Selection.

Two sets of jumpers, at the lower left side of the card, are used to control the Watch Dog output function, this determines which signals are used to generate an interrupt or reset signal or are to be patched through to the watch dog output. The watch dog enable register is an 8 bit read write register, see Chapter 1.

Figure 2-8. Watchdog Output Select.

FACTORY SET



RESLO BUS Approx 1 microsec LOW pulse on timeout
RESHI BUS Approx 1 microsec HIGH pulse on timeout

RESHI OUT Approx 1 microsec HIGH pulse on timeout
RESLO OUT Approx 1 microsec LOW pulse on timeout
GOODLO OUT LOW level= not timed out, low 50 milli sec
GOODHI OUT HIGH level = not timed out, hi 50 milli sec

BUS Jumpers.

The top two jumpers, are the BUS jumpers, determine which pulse is gated onto the PC expansion BUS slots interrupt and reset lines. To actually drive the PC's irq and reset lines the lines must be gated on, under program control, by setting bit 0 for the Reset and bit 1 for the Irq line in the watchdog register.

OUT Jumpers.

The lower four jumpers are the OUT jumpers determining which signal may be output on the PA10 line. To actually output this signal the PA10 out jumper must also be set.

OUT Via PA10 Jumpers.

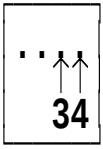
The four pin jumper block at the upper left of the card determines which signal is output, via an opto isolator, on the PA10 line. Either the PA10 line or the signal selected by the Watch Dog OUT jumper may be routed to the edge connector.
Note when using the INVERTING ULN2804 SINK DRIVERS the Watch Dog signal is also inverted by these drivers, thus the RESHI/LO and GOODHI/LO legends are the inverted.

Figure 2-9. Watchdog Output Select.

FACTORY SET

PORT A1 Bit 0 Output. Via Pin 34 of 50D, pin 1 of 50IDC.

WatchDog Out Signal Output. Via Pin 34 of 50D, pin1 of 50IDC.



WatchDog Out Signal Output. Attach flylead for use inside PC
Pin 3 = Watch dog signal NOT OPTICALLY ISOLATED
Pin 4 = PC ground NOT OPTICALLY ISOLATED

Opto DIO48 Memory Map.

The Opto DIO48 has 24 dedicated output lines arranged as 3 eight bit read/write registers, 24 dedicated input lines arranged as 3 eight bit read only registers and one read/write watchdog enable/strobe register. Thus the DIO card occupies 7 consecutive i/o addresses. The output ports are output only, however the output registers are read/write, writing to them sets the level of the output lines, reading them provides a read back of the previously written value. On power up the outputs are zero.

Inputting and outputting data to the Port A, B and C registers senses and sets the values of the pins at the external connector. Writes to the watchdog register gate the Port C2 bit 0 and Bit 3 input signals and the signal selected by the BUS jumper to be gated onto IRQ line or RESET line of the PC. Reading the watchdog register refreshes the timer and postpones timeout for another 50milliseconds.

Figure 2-10. Opto DIO48 Memory Map.

BASE ADDRESS OFFSET	DEFAULT ADDRESS	DEFAULT ADDRESS	DIO PORT	REGISTER SELECTED
0000 R/W	0308 Hex	776 Dec	PORT 0	PORT A#1 OUTPUT PORT A
0001 R/W	0309 Hex	777 Dec	PORT 1	PORT B#1 OUTPUT PORT B
0002 R/W	030A Hex	778 Dec	PORT 2	PORT C#1 OUTPUT PORT C
0003 R/W	030B Hex	779 Dec	PORT 3	WATCH DOG ENABLE REG READ TO REFRESH WATCHDOG
0004 READ	030C Hex	780 Dec	PORT 4	PORT A#2 INPUT PORT A
0005 READ	030D Hex	781 Dec	PORT 5	PORT B#2 INPUT PORT B
0006 READ	030E Hex	782 Dec	PORT 6	PORT C#2 INPUT PORT C

READ/WRITE WATCH DOG ENABLE REGISTER DEFAULT ADDRESS = 030B Hex

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
WRITE	DONT CARE			GATE PORT C2 BIT 3 TO IRQ	GATE PORT C2 BIT 0 TO IRQ	GATE JUMPER BUS TO IRQ	GATE JUMPER BUS TO RESET
READ	ALWAYS 0						

Opto DIO48 Output Specification.

Number Of Port Output Lines.....24
External Power Voltage Range..... 17.5 -35 Volts
Ext Power Supply Reverse Polarity Connection Protected.
Maximum External Power Current
All Outputs High Shorted To All Inputs.....1000 mA @ 24V
WHEN SOURCE DRIVER UDN2984 FITTED
Output Voltage..... 0 - 35 Volts
Can with stand Maximum OFF Voltage.....80 Volts
Sustained Simultaneous O/put Current all lines.....50mA @35V
Max Output Current per 8 line package.....500mA
Peak Output Current any one line..... 350mA
WHEN SINK DRIVER ULN2804 FITTED
Output Voltage..... 6 - 35 Volts
Sustained Simultaneous Output Current on all lines.....375mA
Max Output Current per 8 line package.....3A
Peak Output Current any one line..... 500mA

Opto DIO48 Input Specification.

Number Of Port Input Lines.....24
Input Logic level HIGH..... 2.4 - 24.0 Volts
Input Logic level LOW..... 0.0 - 2.38 Volts
Maximum Input Current One In Line High.....7.25 mA at 24V
Maximum Input Current All In Lines High.....175 mA at 24V
Absolute Maximum Input Voltage.....35 Volts
PC Power Requirements..... 125 mA at 5 Volts
Optical Isolation..... +/- 2500 Volts
Length x Height Of Card.....9.75 x 4.2 inch.
All Inputs Reverse Polarity Connection Protected.

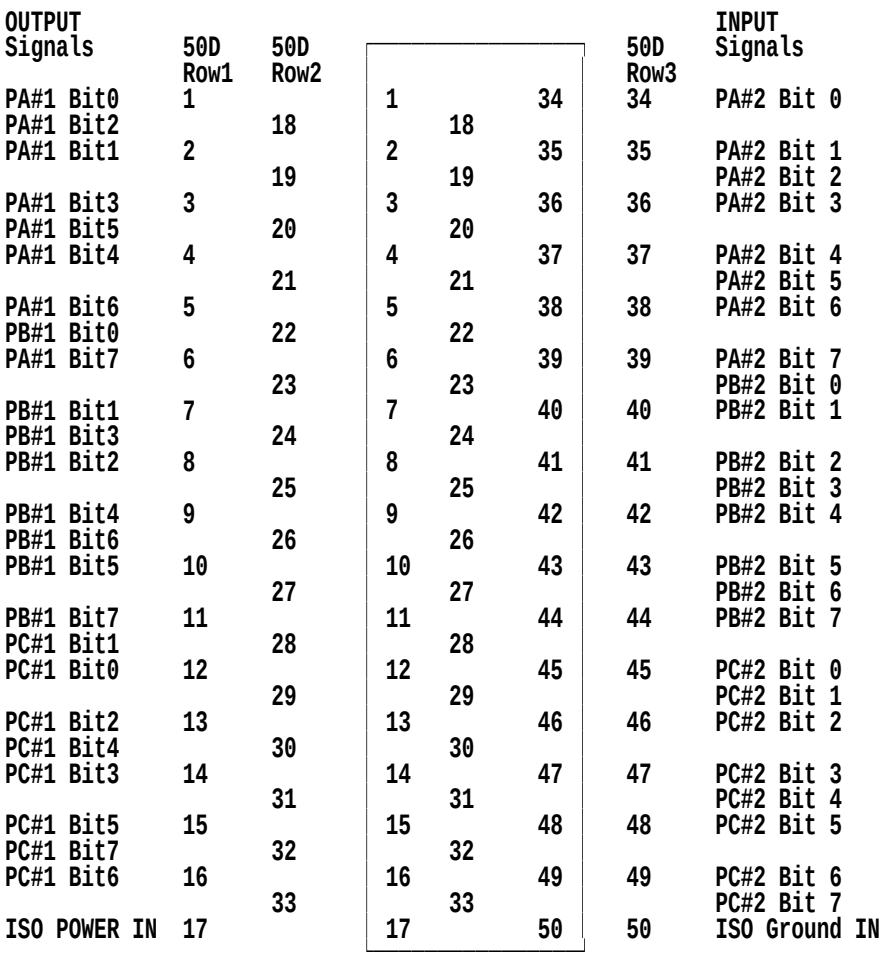
Opto DIO48 Pinouts.

The DIO48 card has either a 50 way IDC or a 50 pin D connector. The 50 way IDC connector has two rows of 25 pins on a 0.1 inch pitch. The 50 way D connector has three rows of 17, 16, 17 pins, on a 2.75 mm pitch.

Figure 2-11. Opto DIO48 J2 Pinouts.

OUTPUT Port0	Bit	PIN		PIN	Bit	INPUT Port 4
PA#1	0	1	1 2	2	0	PA#2
	1	3	3 4	4	1	
	2	5	5 6	6	2	
	3	7	7 8	8	3	
	4	9	0 0	10	4	
	5	11	0 0	12	5	
	6	13	0 0	14	6	
	7	15	0 0	16	7	
Port1	0	17	0 0	18	0	Port 5
PB#1	1	19	0 0	20	1	PB#2
	2	21	0 0	22	2	
	3	23	0 0	24	3	
	4	25	0 0	26	4	
	5	27	0 0	28	5	
	6	29	0 0	30	6	
	7	31	0 0	32	7	
Port2	0	33	0 0	34	0	Port 6
PC#1	1	35	0 0	36	1	PC#2
	2	37	0 0	38	2	
	3	39	0 0	40	3	
	4	41	0 0	42	4	
	5	43	0 0	44	5	
	6	45	0 0	46	6	
	7	47	0 0	48	7	
ISO Power Input		49	49 50	50		ISO Ground Input

Figure 2-12. Opto DIO48 J2 Female 50D Pinout.



OUTPUT Signals	50D Row1	50D Row2			50D Row3	INPUT Signals
PA#1 Bit0	1		1	34	34	PA#2 Bit 0
PA#1 Bit2		18		18		
PA#1 Bit1	2		2	35	35	PA#2 Bit 1
		19		19		PA#2 Bit 2
PA#1 Bit3	3		3	36	36	PA#2 Bit 3
PA#1 Bit5		20		20		
PA#1 Bit4	4		4	37	37	PA#2 Bit 4
		21		21		PA#2 Bit 5
PA#1 Bit6	5		5	38	38	PA#2 Bit 6
PB#1 Bit0		22		22		
PA#1 Bit7	6		6	39	39	PA#2 Bit 7
		23		23		PB#2 Bit 0
PB#1 Bit1	7		7	40	40	PB#2 Bit 1
PB#1 Bit3		24		24		
PB#1 Bit2	8		8	41	41	PB#2 Bit 2
		25		25		PB#2 Bit 3
PB#1 Bit4	9		9	42	42	PB#2 Bit 4
PB#1 Bit6		26		26		
PB#1 Bit5	10		10	43	43	PB#2 Bit 5
		27		27		PB#2 Bit 6
PB#1 Bit7	11		11	44	44	PB#2 Bit 7
PC#1 Bit1		28		28		
PC#1 Bit0	12		12	45	45	PC#2 Bit 0
		29		29		PC#2 Bit 1
PC#1 Bit2	13		13	46	46	PC#2 Bit 2
PC#1 Bit4		30		30		
PC#1 Bit3	14		14	47	47	PC#2 Bit 3
		31		31		PC#2 Bit 4
PC#1 Bit5	15		15	48	48	PC#2 Bit 5
PC#1 Bit7		32		32		
PC#1 Bit6	16		16	49	49	PC#2 Bit 6
		33		33		PC#2 Bit 7
ISO POWER IN	17		17	50	50	ISO Ground IN

CHAPTER 3
OPTO DIO16 CONFIGURATION.

Introduction.

Read Chapter 1 first. This chapter shows how to configure the Opto DIO16 card ready to install in a PC by setting the address select switch and the output driver select block. There is no interrupt or Watch Dog capability on the Opto DIO16.

Opto DIO16 will fit into either 8 or 16 bit slots.

Configuring The Opto DIO16 Card.

The Opto DIO16 card is ready to plug straight into a PC. **Unless there is Good Reason, do not alter its default setting.**

However, due to the large variety of individual PC configurations Opto DIO16 may need adjusting to suit the PC.
The card layout is shown in Figure 3-1. The default settings are i/o address 0308Hex. The source cards have UDN2984 and the sink cards have ULN2803 chips installed.

The Opto DIO16 requires an external power input to power the output drivers and the isolated side of the opto couplers. On card power regulation allows the use of external un-regulated power source, input range 17.5 - 35 Volts. The power supply input is reverse polarity protected.

Setting The Opto DIO16 I/O Address.

By referring to the Opto DIO16 card locate the 6 way DIP switch at the lower left hand corner of the card.

The factory set address, 0308H, is set as shown in Figure 3-2. DIP switches control the base address selected, switches 1-6 correspond to the A3-A8 address lines. The Opto DIO16 card can reside at one of 64 base addresses on an 8 byte boundary

within the range 0200H-03F8H.

The i/o addresses that are likely to be good are in Figure 3-4, addresses to avoid are given in Figure 3-3. Only if the particular card is present need the relevant address be avoided. The software controlling the card must know its i/o address.

Figure 3-1. Opto DIO16 Card Layout.

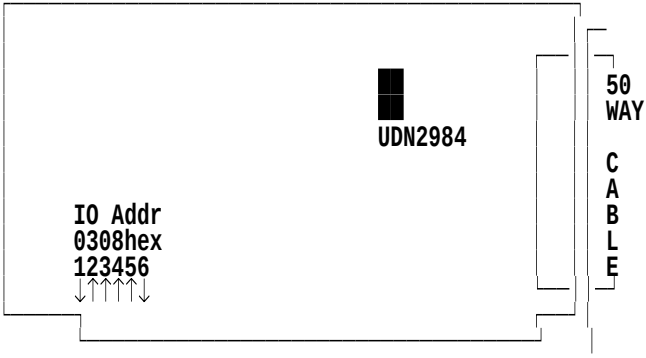


Figure 3-2. Opto DIO16 Factory Set DIP Switches.

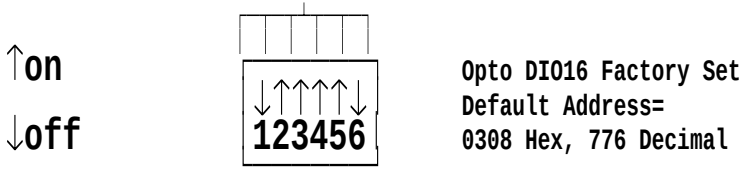


Figure 3-3. Likely I/O Address.

I/O ADDRESS		NORMAL USE.
0204H-	0277H	Unused.
0280H-	02BFH	Unused.
02C8H-	02DFH	Unused.
02E4H-	02F7H	Unused.
0300H-	031FH	Unused.
0330H-	035FH	Unused.
0380H-	03AFH	Unused Usually.
03E0H-	03EFH	Unused.

Figure 3-4. I/O Addresses To Avoid.

I/O ADDRESS	NORMAL USE.
0201H-	0201H Game Control Adapter
0278H-	027FH *** Second Printer Port Adapter
02E1H	*** PC ELITE IEEE Card.
02E1H	IBM/ National Instruments IEEE card.
02F8H-	02FFH *** COM2 Serial Port
0300H-	031FH NE2000 Network Card.
0300H-	030FH 3COM Network Card.
0300H-	0307H *** PC Proto card
0300H-	0303H *** PC IEEE Card
0300H-	0303H *** PC DIO24 Card
0308H-	030BH *** PC OPTO OUT24 Card
0308H-	030FH *** Opto OUT48, Opto DIO16, OptoDIO48 & DIO48 Cards
030CH-	030FH *** PC OPTO IN24 Card
0310H-	031FH *** PC Timer-DIO Card
0340H-	0360H *** PC DIO192 Card
0378H-	037FH *** Printer Port Adapter
03B0H-	03DFH VGA /SVGA card
03F0H-	03F7H Floppy Disk Drive Drive.
03F8H-	03FFH *** COM1 Serial Port.

*** These cards available from us.

Using More Than One Opto DIO16 Board.

Several Opto DIO cards can be installed at the same time, allowing each card to control its own set of i/o lines.

The golden rule is:- Ensure that each card is set to a different i/o address and the ranges do not overlap!

Figure 3-5. Opto DIO16 Base Addresses.

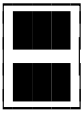
DIP1	DIP2	DIP3	DIP4	DIP5	DIP6		Base Address Of Card	
Off	Off	Off	Off	Off	Off	↓↓↓↓↓↓	03F8 Hex	1016 Dec
On	Off	Off	Off	Off	Off	↑↓↓↓↓↓	03F0 Hex	1008 Dec
Off	On	Off	Off	Off	Off	↓↑↓↓↓↓	03E8 Hex	1000 Dec
On	On	Off	Off	Off	Off	↑↑↓↓↓↓	03E0 Hex	992 Dec
Off	Off	On	Off	Off	Off	↓↓↑↓↓↓	03D8 Hex	984 Dec
On	Off	On	Off	Off	Off	↑↓↑↓↓↓	03D0 Hex	976 Dec
Off	On	On	Off	Off	Off	↓↑↑↓↓↓	03C8 Hex	968 Dec
On	On	On	Off	Off	Off	↑↑↑↓↓↓	03C0 Hex	960 Dec
Off	Off	Off	On	Off	Off	↓↓↓↑↓↓	03B8 Hex	952 Dec
On	Off	Off	On	Off	Off	↑↓↓↑↓↓	03B0 Hex	944 Dec

Off	On	Off	On	Off	Off		03A8 Hex	936 Dec
On	On	Off	On	Off	Off		03A0 Hex	928 Dec
Off	Off	On	On	Off	Off		0398 Hex	920 Dec
On	Off	On	On	Off	Off		0390 Hex	912 Dec
Off	On	On	On	Off	Off		0388 Hex	904 Dec
On	On	On	On	Off	Off		0380 Hex	896 Dec
Off	Off	Off	Off	On	Off		0378 Hex	888 Dec
On	Off	Off	Off	On	Off		0370 Hex	880 Dec
Off	On	Off	Off	On	Off		0368 Hex	872 Dec
On	On	Off	Off	On	Off		0360 Hex	864 Dec
Off	Off	On	Off	On	Off		0358 Hex	856 Dec
On	Off	On	Off	On	Off		0350 Hex	848 Dec
Off	On	On	Off	On	Off		0348 Hex	840 Dec
On	On	On	Off	On	Off		0340 Hex	832 Dec
Off	Off	Off	On	On	Off		0338 Hex	824 Dec
On	Off	Off	On	On	Off		0330 Hex	816 Dec
Off	On	Off	On	On	Off		0328 Hex	808 Dec
On	On	Off	On	On	Off		0320 Hex	800 Dec
Off	Off	On	On	On	Off		0318 Hex	792 Dec
On	Off	On	On	On	Off		0310 Hex	784 Dec
Off	On	On	On	On	Off		0308 Hex	776 Deflt
On	On	On	On	On	Off		0300 Hex	768 Dec
Off	Off	Off	Off	Off	On		02F8 Hex	760 Dec
On	Off	Off	Off	Off	On		02F0 Hex	752 Dec
Off	On	Off	Off	Off	On		02E8 Hex	744 Dec
On	On	Off	Off	Off	On		02E0 Hex	736 Dec
Off	Off	On	Off	Off	On		02D8 Hex	728 Dec
On	Off	On	Off	Off	On		02D0 Hex	720 Dec
Off	On	On	Off	Off	On		02C8 Hex	712 Dec
On	On	On	Off	Off	On		02C0 Hex	704 Dec
Off	Off	Off	On	Off	On		02B8 Hex	696 Dec
On	Off	Off	On	Off	On		02B0 Hex	688 Dec
Off	On	Off	On	Off	On		02A8 Hex	680 Dec
On	On	Off	On	Off	On		02A0 Hex	672 Dec
Off	Off	On	On	Off	On		0298 Hex	664 Dec
On	Off	On	On	Off	On		0290 Hex	656 Dec
Off	On	On	On	Off	On		0288 Hex	648 Dec
On	On	On	On	Off	On		0280 Hex	640 Dec
Off	Off	Off	Off	On	On		0278 Hex	632 Dec
On	Off	Off	Off	On	On		0270 Hex	624 Dec

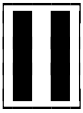
Off	On	Off	Off	On	On	↓↑↓↓↑↑	0268 Hex	616 Dec
On	On	Off	Off	On	On	↑↑↓↓↑↑	0260 Hex	608 Dec
Off	Off	On	Off	On	On	↓↓↑↓↑↑	0258 Hex	600 Dec
On	Off	On	Off	On	On	↑↓↑↓↑↑	0250 Hex	592 Dec
Off	On	On	Off	On	On	↓↑↑↓↑↑	0248 Hex	584 Dec
On	On	On	Off	On	On	↑↑↑↓↑↑	0240 Hex	576 Dec
Off	Off	Off	On	On	On	↓↓↓↑↑↑	0238 Hex	568 Dec
On	Off	Off	On	On	On	↑↓↓↑↑↑	0230 Hex	560 Dec
Off	On	Off	On	On	On	↓↑↓↑↑↑	0228 Hex	552 Dec
On	On	Off	On	On	On	↑↑↓↑↑↑	0220 Hex	544 Dec
Off	Off	On	On	On	On	↓↓↑↑↑↑	0218 Hex	536 Dec
On	Off	On	On	On	On	↑↓↑↑↑↑	0210 Hex	528 Dec
Off	On	On	On	On	On	↓↑↑↑↑↑	0208 Hex	520 Dec
On	On	On	On	On	On	↑↑↑↑↑↑	0200 Hex	512 Dec

Figure 3-6. Driver Chip Select.

FACTORY SET



UDN2984 Source Drivers Selected — RN14 installed 10K resistor networks



ULN2804 Sink Drivers Selected — Remove RN14

UDN2984 ULN2804 Driver Selection.

The card can be configured to use one of two types of high voltage drive chips ULN2804 or UDN 2984 chips. Chapter 1 explains the difference and function of these two driver types. Figure 3-1 shows the jumper pins used to make the selection.

Source Driver Output Connection.

UDN2984 Drivers.

The UDN2984 chips are high voltage, high current SOURCE drivers, output voltage range 35 to 80 Volts, these could be

directly replaced by UDN2981 drivers for output voltages in the range 5 to 50 Volts. Whilst the 2984 drivers have built in output transient suppression diodes, extra diodes are provided on card the Opto DIO16 card for extra protection. The socketed 10k resistor network RN14 should be left installed.
For normal operation, with UDN2984 chips installed, socket U26 contains an non inverting buffer chip 74LS541.
For inverse operation, an inverting buffer chip 74LS540 should be installed in socket U26.

Sink Driver Output Connection.

ULN2804 Drivers.

The ULN2804 chips are high voltage, high current NPN DARLINGTON drivers, output voltage range to 50 Volts, these could be directly replaced by ULN2824 chips for output voltages up to 95 Volts. The 2804 have open collector outputs. When changing from 2984 to 2804 drivers note than the 2804 are INVERTING drivers, thus to produce the same logical output from a bit pattern written to the output port the 74LS541 chips would have to be replaced by the inverting 74LS540 chips. Remove the socketed 10k resistor network RN14.
For inverse operation, then an non inverting buffers chip 74LS541 should be installed in socket U26.

Opto DIO16 Memory Map.

The Opto DIO16 has 8 dedicated output lines arranged as one eight bit read/write register, 8 dedicated input lines arranged as one eight bit read only register. Thus the DIO16 card occupies 2 consecutive i/o addresses. The output ports is output only, however the output register is read/write, writing to it sets the level of the output lines, reading it provides a read back of the previously written value. On power up the outputs are zero.

Inputting and outputting data to the port registers senses and sets the values of the pins at the external connector.

Figure 3-7. Opto DIO16 Memory Map.

BASE ADDRESS OFFSET	DEFAULT ADDRESS	DEFAULT ADDRESS	DIO PORT	REGISTER SELECTED
0000 R/W	0308 Hex	776 Dec	PORT 0	PORT A#1 OUTPUT PORT A
0001 READ	030C Hex	780 Dec	PORT 1	PORT A#2 INPUT PORT A

OPTO DIO16 Output Specification.

Number Of Port Output Lines..... 8
External Power Voltage Range.....17.5 -35 Volts
Ext Power Supply Reverse Polarity Connection Protected.
Maximum External Power Current
All Outputs High Shorted To All Inputs.....330 mA @ 24V
WHEN SOURCE DRIVER UDN2984 FITTED
Output Voltage.....0 - 35 Volts
Can with stand Maximum OFF Voltage.....80 Volts
Sustained Simultaneous O/put Current all lines.....50mA @35V
Max Output Current per 8 line package.....500mA
Peak Output Current any one line.....350mA
WHEN SINK DRIVER ULN2804 FITTED
Output Voltage.....6 - 35 Volts
Sustained Simultaneous Output Current on all lines.....375mA
Max Output Current per 8 line package.....3A
Peak Output Current any one line.....500mA

OPTO DIO16 Input Specification.
Number Of Port Input Lines..... 8
Input Logic level HIGH.....2.4 - 24.0 Volts
Input Logic level LOW.....0.0 - 2.38 Volts
Maximum Input Current One In Line High.....7.25 mA at 24V
Maximum Input Current All In Lines High.....175 mA at 24V
Absolute Maximum Input Voltage.....35 Volts
PC Power Requirements.....125 mA at 5 Volts
Optical Isolation..... +/- 2500 Volts
Length x Height Of Card..... 5.00 x 4.2 inch.
All Inputs Reverse Polarity Connection Protected.

Opto DIO16 Pinouts.

The DIO16 card has either a 50 way IDC or a 50 pin D connector. The 50 way IDC connector has two rows of 25 pins on a 0.1 inch pitch. The 50 way D connector has three rows of 17, 16, 17 pins, on a 2.75 mm pitch.

Only Pins 1-16 and 49 and 50 have any connection.

Figure 3-8. Opto DIO16 J2 Pinouts.

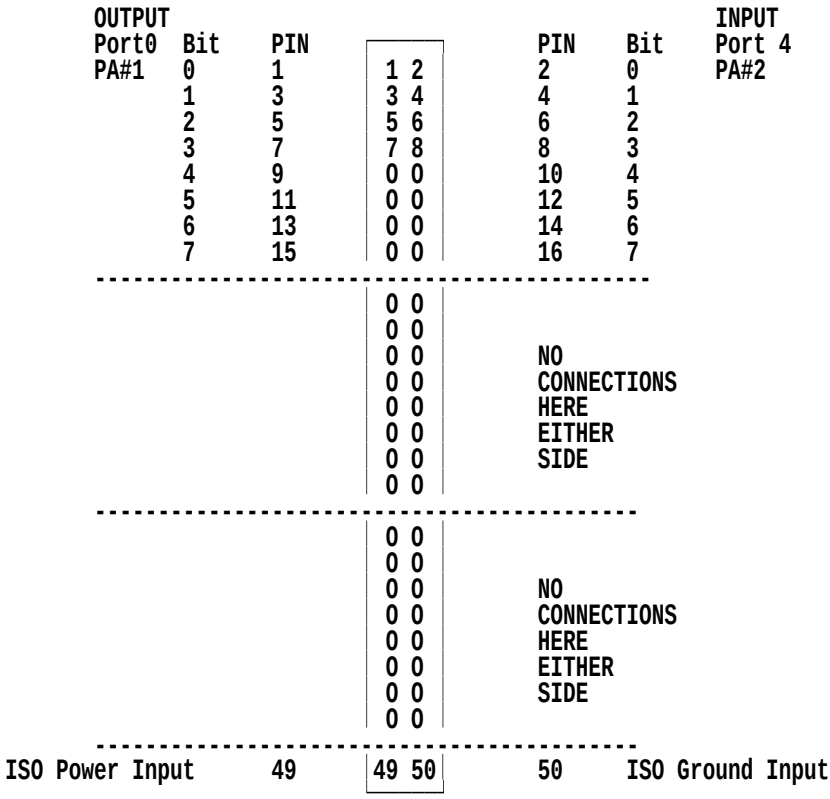
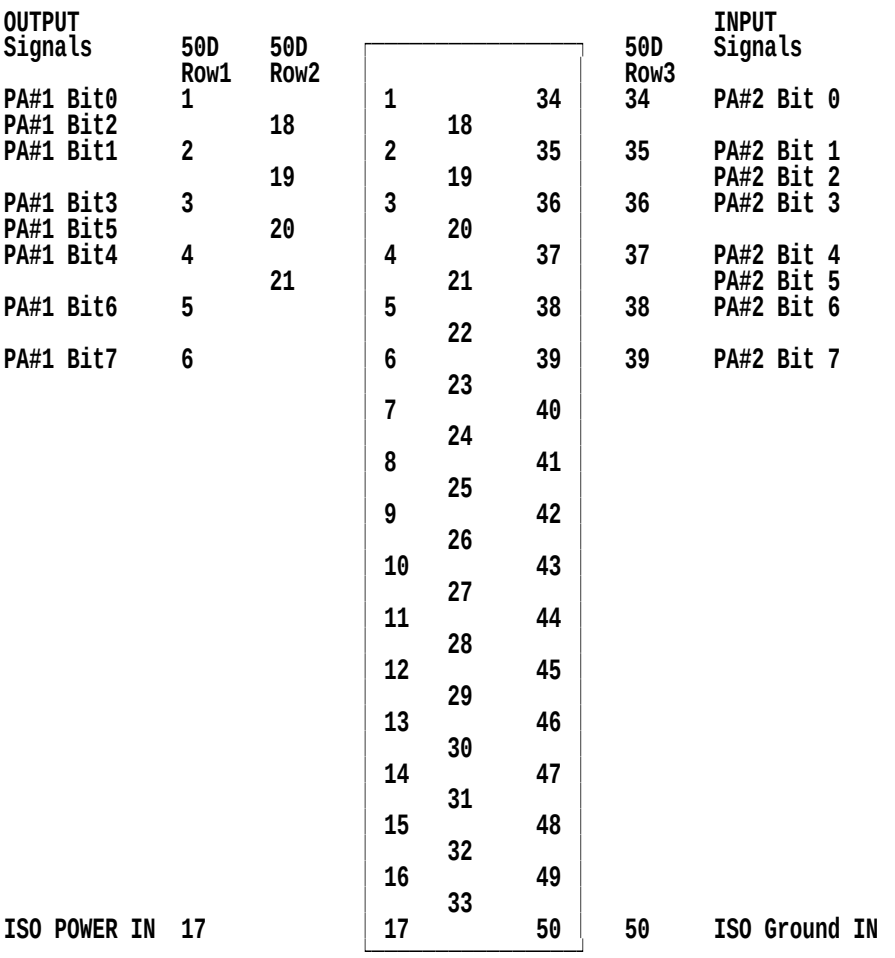


Figure 3-9. Opto DIO16 J2 Female 50D Pinout.



Only Pins 1-6, 18-21, 34-39, 17 and 50 have any connection.

CHAPTER 4
OPTO OUT48 CONFIGURATION

Introduction.

Read Chapter 1 first. This chapter explains how to configure the Opto OUT48 card ready to install into a PC. Instructions on how to set the address select, the IRQ jumper block and the output driver select jumper block are given. The settings of the watch dog timer output are also explained.

The full size Opto OUT48 will fit into 8 or 16 bit slots.

Configuring The Opto OUT48 Card.

The Opto OUT48 card is ready to plug straight into a PC. **Unless there is Good Reason, do not alter its default setting.**

However, due to the large variety of individual PC configurations Opto OUT48 may need adjusting to suit the PC.

The default settings are i/o address 0308Hex, IRQ 7 selected but not enabled, WATCHDOG VIA PA10 disabled- the PA10 line is output- and the WATCH DOG OUTPUT OPTIONS, GOODLO output jumpered to OUT, RESHI output jumpered to BUS. The source cards have UDN2984 and the sink cards have ULN2803 chips installed. See Figure 4-1.

The Opto DIO cards requires an external power input to power the output drivers and the isolated side of the Opto couplers. On card power regulation allows the use of external un-regulated power source, input range 17.5 - 35 Volts. The power supply input is reverse polarity protected.

Setting The Opto OUT48 I/O Address.

By referring to the Opto OUT48 card locate the 8 way I/O Address DIP switches at the left hand corner of the card.

The factory set address, 0308H, is set as shown in Figure 4-2. DIP switches determine the Opto OUT48 card i/o base address select, DIP switches 1-7 correspond to the A3-A9 address lines, respectively. DIP switch 8 is not connected.

The Opto OUT48 card can reside at one of 96 base addresses on an 8 byte boundary within the range 0100H-03F8H. The factory set default address is 0308hex.

The i/o addresses that are likely to be good in Figure 4-4. addresses to avoid is given in Figure 4-3. Only if the particular adapter card is present need the relevant address be avoided.

Figure 4-1. Opto OUT48 Card Layout.

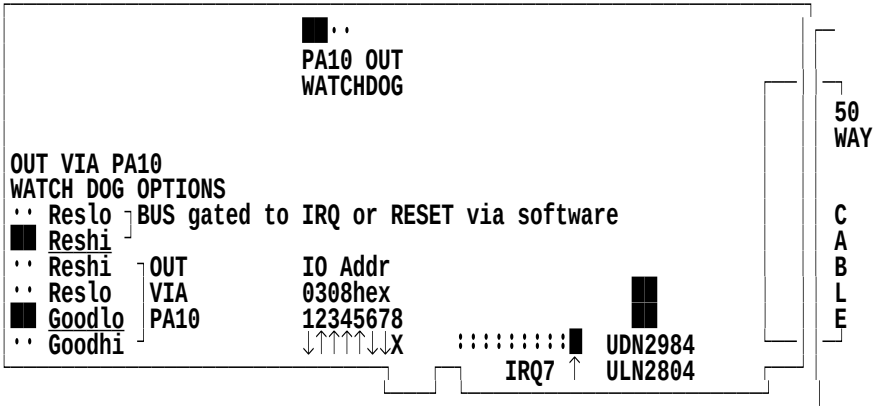
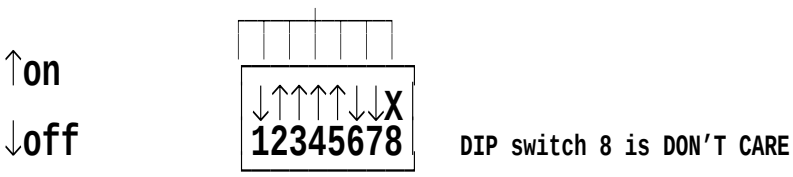


Figure 4-2. Opto OUT48 Factory Set DIP Switches.



Opto OUT48 Factory Set Default Address= 0308 Hex, 776 Decimal

Figure 4-4. I/O Addresses To Avoid.

I/O ADDRESS		NORMAL USE.
0201H-	0201H	Game Control Adapter
0278H-	027FH	*** Second Printer Port Adapter
02E1H		*** PC ELITE IEEE Card.
02E1H		IBM/ National Instruments IEEE card.
02F8H-	02FFH	*** COM2 Serial Port
0300H-	031FH	NE2000 Network Card.
0300H-	030FH	3COM Network Card.
0300H-	0307H	*** PC Proto card
0300H-	0303H	*** PC IEEE Card
0300H-	0303H	*** PC DIO24 Card
0308H-	030BH	*** PC Opto OUT24 Card
0308H-	030FH	*** Opto OUT48, Opto DIO16, OptoDIO48 & DIO48 Cards
030CH-	030FH	*** PC Opto IN24 Card
0310H-	031FH	*** PC Timer-DIO Card
0340H-	0360H	*** PC DIO192 Card
0378H-	037FH	*** Printer Port Adapter
03B0H-	03DFH	VGA /SVGA card
03F0H-	03F7H	Floppy Disk Drive Drive.
03F8H-	03FFH	*** COM1 Serial Port.

*** These cards available from us.

Figure 4-4. Likely I/O Address.

I/O ADDRESS		NORMAL USE.
0204H-	0277H	Unused.
0280H-	02BFH	Unused.
02C8H-	02DFH	Unused.
02E4H-	02F7H	Unused.
0300H-	031FH	Unused.
0330H-	035FH	Unused.
0380H-	03AFH	Unused Usually.
03E0H-	03EFH	Unused.

Figure 4-5. Opto OUT48 Base Addresses.

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	Base Address 300-3F8	
Off	Off	Off	Off	Off	Off	Off	03F8 Hex	1016 Dec
On	Off	Off	Off	Off	Off	Off	03F0 Hex	1008 Dec
Off	On	Off	Off	Off	Off	Off	03E8 Hex	1000 Dec
On	On	Off	Off	Off	Off	Off	03E0 Hex	992 Dec
Off	Off	On	Off	Off	Off	Off	03D8 Hex	984 Dec
On	Off	On	Off	Off	Off	Off	03D0 Hex	976 Dec
Off	On	On	Off	Off	Off	Off	03C8 Hex	968 Dec

On	On	On	Off	Off	Off	Off	03C0 Hex	960 Dec
Off	Off	Off	On	Off	Off	Off	03B8 Hex	952 Dec
On	Off	Off	On	Off	Off	Off	03B0 Hex	944 Dec
Off	On	Off	On	Off	Off	Off	03A8 Hex	936 Dec
On	On	Off	On	Off	Off	Off	03A0 Hex	928 Dec
Off	Off	On	On	Off	Off	Off	0398 Hex	920 Dec
On	Off	On	On	Off	Off	Off	0390 Hex	912 Dec
Off	On	On	On	Off	Off	Off	0388 Hex	904 Dec
On	On	On	On	Off	Off	Off	0380 Hex	896 Dec
Off	Off	Off	Off	On	Off	Off	0378 Hex	888 Dec
On	Off	Off	Off	On	Off	Off	0370 Hex	880 Dec
Off	On	Off	Off	On	Off	Off	0368 Hex	872 Dec
On	On	Off	Off	On	Off	Off	0360 Hex	864 Dec
Off	Off	On	Off	On	Off	Off	0358 Hex	856 Dec
On	Off	On	Off	On	Off	Off	0350 Hex	848 Dec
Off	On	On	Off	On	Off	Off	0348 Hex	840 Dec
On	On	On	Off	On	Off	Off	0340 Hex	832 Dec
Off	Off	Off	On	On	Off	Off	0338 Hex	824 Dec
On	Off	Off	On	On	Off	Off	0330 Hex	816 Dec
Off	On	Off	On	On	Off	Off	0328 Hex	808 Dec
On	On	Off	On	On	Off	Off	0320 Hex	800 Dec
Off	Off	On	On	On	Off	Off	0318 Hex	792 Dec
On	Off	On	On	On	Off	Off	0310 Hex	784 Dec
Off	On	On	On	On	Off	Off	0308 Hex	776 Deflt
On	On	On	On	On	Off	Off	0300 Hex	768 Dec

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	Base Address 2F8-200	
Off	Off	Off	Off	Off	On	Off	02F8 Hex	760 Dec
On	Off	Off	Off	Off	On	Off	02F0 Hex	752 Dec
Off	On	Off	Off	Off	On	Off	02E8 Hex	744 Dec
On	On	Off	Off	Off	On	Off	02E0 Hex	736 Dec
Off	Off	On	Off	Off	On	Off	02D8 Hex	728 Dec
On	Off	On	Off	Off	On	Off	02D0 Hex	720 Dec
Off	On	On	Off	Off	On	Off	02C8 Hex	712 Dec
On	On	On	Off	Off	On	Off	02C0 Hex	704 Dec
Off	Off	Off	On	Off	On	Off	02B8 Hex	696 Dec
On	Off	Off	On	Off	On	Off	02B0 Hex	688 Dec
Off	On	Off	On	Off	On	Off	02A8 Hex	680 Dec
On	On	Off	On	Off	On	Off	02A0 Hex	672 Dec
Off	Off	On	On	Off	On	Off	0298 Hex	664 Dec
On	Off	On	On	Off	On	Off	0290 Hex	656 Dec

Off	On	On	On	Off	On	Off	0288 Hex	648 Dec
On	On	On	On	Off	On	Off	0280 Hex	640 Dec
Off	Off	Off	Off	On	On	Off	0278 Hex	632 Dec
On	Off	Off	Off	On	On	Off	0270 Hex	624 Dec
Off	On	Off	Off	On	On	Off	0268 Hex	616 Dec
On	On	Off	Off	On	On	Off	0260 Hex	608 Dec
Off	Off	On	Off	On	On	Off	0258 Hex	600 Dec
On	Off	On	Off	On	On	Off	0250 Hex	592 Dec
Off	On	On	Off	On	On	Off	0248 Hex	584 Dec
On	On	On	Off	On	On	Off	0240 Hex	576 Dec
Off	Off	Off	On	On	On	Off	0238 Hex	568 Dec
On	Off	Off	On	On	On	Off	0230 Hex	560 Dec
Off	On	Off	On	On	On	Off	0228 Hex	552 Dec
On	On	Off	On	On	On	Off	0220 Hex	544 Dec
Off	Off	On	On	On	On	Off	0218 Hex	536 Dec
On	Off	On	On	On	On	Off	0210 Hex	528 Dec
Off	On	On	On	On	On	Off	0208 Hex	520 Dec
On	On	On	On	On	On	Off	0200 Hex	512 Dec

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	I/O Address 1F8-100	
Off	Off	Off	Off	Off	Off	On	01F8 Hex	504 Dec
On	Off	Off	Off	Off	Off	On	01F0 Hex	496 Dec
Off	On	Off	Off	Off	Off	On	01E8 Hex	488 Dec
On	On	Off	Off	Off	Off	On	01E0 Hex	480 Dec
Off	Off	On	Off	Off	Off	On	01D8 Hex	472 Dec
On	Off	On	Off	Off	Off	On	01D0 Hex	464 Dec
Off	On	On	Off	Off	Off	On	01C8 Hex	456 Dec
On	On	On	Off	Off	Off	On	01C0 Hex	448 Dec
Off	Off	Off	On	Off	Off	On	01B8 Hex	440 Dec
On	Off	Off	On	Off	Off	On	01B0 Hex	432 Dec
Off	On	Off	On	Off	Off	On	01A8 Hex	424 Dec
On	On	Off	On	Off	Off	On	01A0 Hex	416 Dec
Off	Off	On	On	Off	Off	On	0198 Hex	408 Dec
On	Off	On	On	Off	Off	On	0190 Hex	400 Dec
Off	On	On	On	Off	Off	On	0188 Hex	392 Dec
On	On	On	On	Off	Off	On	0180 Hex	384 Dec
Off	Off	Off	Off	On	Off	On	0178 Hex	376 Dec
On	Off	Off	Off	On	Off	On	0170 Hex	368 Dec
Off	On	Off	Off	On	Off	On	0168 Hex	360 Dec
On	On	Off	Off	On	Off	On	0160 Hex	352 Dec
Off	Off	On	Off	On	Off	On	0158 Hex	344 Dec

On	Off	On	Off	On	Off	On	0150 Hex	336 Dec
Off	On	On	Off	On	Off	On	0148 Hex	328 Dec
On	On	On	Off	On	Off	On	0140 Hex	320 Dec
Off	Off	Off	On	On	Off	On	0138 Hex	312 Dec
On	Off	Off	On	On	Off	On	0130 Hex	304 Dec
Off	On	Off	On	On	Off	On	0128 Hex	296 Dec
On	On	Off	On	On	Off	On	0120 Hex	288 Dec
Off	Off	On	On	On	Off	On	0118 Hex	280 Dec
On	Off	On	On	On	Off	On	0110 Hex	272 Dec
Off	On	On	On	On	Off	On	0108 Hex	264 Deflt
On	On	On	On	On	Off	On	0100 Hex	256 Dec

Using More Than One Opto OUT48 Card.

Several Opto DIO cards can be installed at the same time, allowing each card to control its own set of i/o lines.

The golden rule is:- Ensure that each card is set to a different i/o address and the ranges do not overlap!

Figure 4-6. Driver Chip Select.

FACTORY SET

UDN2984 Source Drivers Selected

RN3, 5, 13 and RN7, 9 and 11 installed 10K resistor networks

ULN2804 Sink Drivers Selected

Remove RN3, 5 and 13
Remove RN7, 9 and 11

UDN2984 ULN2804 Driver Selection.

The card can be configured to use one of two types of high voltage drive chips ULN2804 or UDN 2984 chips. Chapter 1 explains the difference between these two types.

The two jumper pins directly below and just to the left of the driver chips is used to made the selection.

Source Driver Output Connection.

UDN2984 Drivers.

The UDN2984 chips are high voltage, high current SOURCE drivers, output voltage range 35 to 80 Volts, these could be directly replaced by UDN2981 drivers for output voltages in the range 5 to 50 Volts. Whilst the 2984/81 drivers have built in output transient suppression diodes, extra diodes are provided on the card for extra protection. The socketed 10k resistor networks RN3, 5, 13 and RN7, 9 and 11 should be left installed.

For normal operation, 2984s installed, sockets U26, U28, U30, U35, U37 and U39 hold non inverting buffers chips 74LS541.

For inverse operation, inverting buffers chips 74LS540 should be installed in sockets U26, U28, U30, U35, U37 and U39.

Sink Driver Output Connection.

ULN2804 Drivers.

The ULN2804 chips are high voltage, high current open collector NPN DARLINGTON drivers, output voltage range to 50 Volts. These could be directly replaced by ULN2824 chips for output voltages up to 95 Volts. When changing from 2984 to 2804 drivers note than the 2804 are INVERTING drivers, thus to produce the same logical output from a bit pattern written to the output port the 74LS541 chips would have to be replaced by the inverting 74LS540 chips. Remember to remove the socketed 10k resistor networks RN3, 5, 7, 9, 11 and 13.

For inverse operation, the non inverting buffers chips 74LS541 should be placed in sockets U26, U28, U30, U35, U37 and U39.

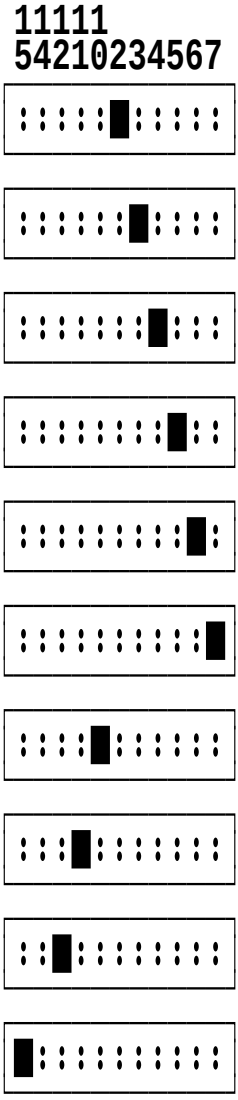
Interrupt Selection.

The Opto OUT48 card can produce interrupts from low to high transitions on of the Watch Dog timeout line.

The IRQ must be ENABLED in software AND the IRQ jumper must both be set before any IRQ requests are generated. The users program sets the IRQ enable bits in the watch dog register

to selects which OUT48 signal generates the interrupt, the IRQ jumper selects which PC interrupt is asserted and so which software interrupt service routine is called.

Figure 4-7. The IRQ Jumper Block.

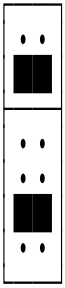

11111
54210234567
NORMAL USE OF INTERRUPT.
IRQ2 EGA/VGA GRAPHICS CARD, Usually Free
Used by only very few graphics cards.
IRQ3 COM 2- COM 8.
IRQ4 COM 1.
IRQ5 PRINTER PORT#2 OK for DOS & Windows
Avoid for OS/2, Windows NT & Novell
IRQ6 FLOPPY DISK DRIVE, AVOID!.
IRQ7 PRINTER PORT#1 OK for DOS & Windows
Avoid for OS/2, Windows NT & Novell
IRQ10 Usually Free
IRQ11 Usually Free
IRQ12 POINTING DEVICE, Usually Free
Free when mouse is on a COM port.
IRQ15 Usually Free

Watch Dog Selection.

Two sets of jumpers, at the lower left side of the card, are used to control the Watch Dog output function, this determines which signals are used to generate an interrupt or reset signal or are to be patched through to the watch dog output. The watch dog enable register is an 8 bit read write register, see Chapter 1.

Figure 4-8. Watchdog Output Select.

FACTORY SET



```
RESLO BUS    Approx 1 microsec LOW pulse on timeout
RESHI BUS    Approx 1 microsec HIGH pulse on timeout

RESHI OUT    Approx 1 microsec HIGH pulse on timeout
RESLO OUT    Approx 1 microsec LOW pulse on timeout
GOODLO OUT   LOW level= not timed out, low 50 milli sec
GOODHI OUT   HIGH level = not timed out, hi 50 milli sec
```

BUS Jumpers.

The top two jumpers, are the BUS jumpers, determine which pulse is gated onto the PC expansion BUS slots interrupt and reset lines. To actually drive the PC's irq and reset lines the lines must be gated on, under program control, by setting bit 0 for the Reset and bit 1 for the Irq line in the watchdog register.

OUT Jumpers.

The lower four jumpers are the OUT jumpers determining which signal may be output on the PA10 line. To actually output this signal the PA10 out jumper must also be set.

OUT Via PA10 Jumpers.

The four pin jumper block at the upper left of the card determines which signal is output, via an opto isolator, on the PA10 line. Either the PA10 line or the signal selected by the Watch Dog OUT jumper may be routed to the edge connector.

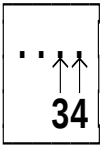
Note when using the INVERTING ULN2804 SINK DRIVERS the Watch Dog signal is also inverted by these drivers, thus the RESHI/LO and GOODHI/LO legends are the inverted.

Figure 4-9. Watchdog Output Select.

FACTORY SET

PORT A1 Bit 0 Output. Via Pin 34 of 50D, pin 1 of 50IDC.

WatchDog Out Signal Output. Via Pin 34 of 50D, pin1 of 50IDC.



WatchDog Out Signal Output. Attach flylead for use inside PC
Pin 3 = Watch dog signal NOT OPTICALLY ISOLATED
Pin 4 = PC ground NOT OPTICALLY ISOLATED

Opto DIO48 Memory Map.

The Opto OUT48 has 48 dedicated output lines arranged as 6 eight bit read/write registers and one read/write watchdog enable/strobe register and one unused register. So the OUT48 card occupies 8 consecutive i/o addresses. See Figure 4-10. The output ports are output only, however the output registers are read/write, writing to them sets the level of the output lines, reading them provides a read back of the previously written value. On power up, all the output lines are reset to zero, low, ie the output drivers are off.

Writing data to the Port A#1, B#1, C#1, A#2, B#2 or C#2 registers sets the external output line high or low. Reading from the ports returns the previously set value. Writes to the watchdog register gate the signal selected by the BUS jumper onto IRQ line or RESET line of the PC. Reading the watchdog register refreshes the timer postponing timeout for another 50millisecond.

Figure 4-10. Opto OUT48 Memory Map.

BASE ADDRESS OFFSET	DEFAULT ADDRESS	DEFAULT ADDRESS	DIO PORT	REGISTER SELECTED
0000 R/W	0308 Hex	776 Dec	PORT 1	PORT A#1 OUTPUT PORT A
0001 R/W	0309 Hex	777 Dec	PORT 2	PORT B#1 OUTPUT PORT B
0002 R/W	030A Hex	778 Dec	PORT 3	PORT C#1 OUTPUT PORT C
0003 R/W	030B Hex	779 Dec	PORT 4	NOT USED
0004 R/W	030C Hex	780 Dec	PORT 5	PORT A#2 OUTPUT PORT A
0005 R/W	030D Hex	781 Dec	PORT 6	PORT B#2 OUTPUT PORT B
0006 R/W	030E Hex	782 Dec	PORT 7	PORT C#2 OUTPUT PORT C
0007 R/W	030F Hex	783 Dec	PORT 8	WATCH DOG ENABLE REG READ TO REFRESH WATCHDOG
NOTE: ON RESET ALL OUTPUTS ARE SET TO ZERO, =LOW, =OUTPUTS OFF				

OPTO OUT48 Output Specification.

Number Of Port Output Lines..... 48
External Power Voltage Range.....17.5 -35 Volts
Ext Power Supply Reverse Polarity Connection Protected.
Maximum External Power Current
All Outputs High Shorted To All Inputs.....2000 mA @ 24V
WHEN SOURCE DRIVER UDN2984 FITTED
Output Voltage.....0 - 35 Volts
Can with stand Maximum OFF Voltage.....80 Volts
Sustained Simultaneous O/put Current all lines.....50mA @35V
Max Output Current per 8 line package.....500mA
Peak Output Current any one line.....350mA
WHEN SINK DRIVER ULN2804 FITTED
Output Voltage.....6 - 35 Volts
Sustained Simultaneous Output Current on all lines.....375mA
Max Output Current per 8 line package.....3A
Peak Output Current any one line.....500mA
PC Power Requirements.....125 mA at 5 Volts
Optical Isolation..... +/- 2500 Volts
Length x Height Of Card..... 12.7 x 4.2 inch.

Opto OUT48 Pinouts.

The OUT48 card has either a 50 way IDC or a 50 pin D connector. The 50 way IDC connector has two rows of 25 pins on a 0.1 inch pitch. The 50 way D connector has three rows of 17, 16, 17 pins, on a 2.75 mm pitch.

Figure 4-11. Opto OUT48 J2 Pin Outs.

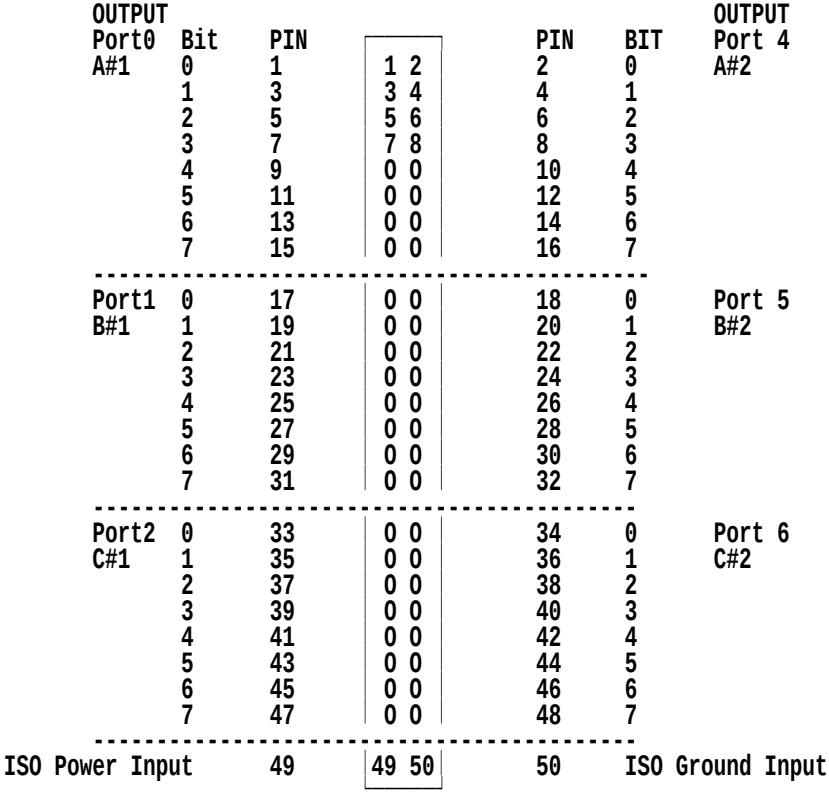


Figure 4-12. Opto OUT48 J2 Female 50D Pinout.

OUTPUT Signals	50D Row1	50D Row2			50D Row3	OUTPUT Signals
PA#2 Bit 0	1		1	34	34	PA#1 Bit 0
PA#2 Bit 2		18		18		
PA#2 Bit 1	2		2	35	35	PA#1 Bit 1
		19		19		PA#1 Bit 2
PA#2 Bit 3	3		3	36	36	PA#1 Bit 3
PA#2 Bit 5		20		20		
PA#2 Bit 4	4		4	37	37	PA#1 Bit 4
		21		21		PA#1 Bit 5
PA#2 Bit 6	5		5	38	38	PA#1 Bit 6
PB#2 Bit 0		22		22		
PA#2 Bit 7	6		6	39	39	PA#1 Bit 7
		23		23		PB#1 Bit 0
PB#2 Bit 1	7		7	40	40	PB#1 Bit 1
PB#2 Bit 3		24		24		
PB#2 Bit 2	8		8	41	41	PB#1 Bit 2
		25		25		PB#1 Bit 3
PB#2 Bit 4	9		9	42	42	PB#1 Bit 4
PB#2 Bit 6		26		26		
PB#2 Bit 5	10		10	43	43	PB#1 Bit 5
		27		27		PB#1 Bit 6
PB#2 Bit 7	11		11	44	44	PB#1 Bit 7
PC#2 Bit 1		28		28		
PC#2 Bit 0	12		12	45	45	PC#1 Bit 0
		29		29		PC#1 Bit 1
PC#2 Bit 2	13		13	46	46	PC#1 Bit 2
PC#2 Bit 4		30		30		
PC#2 Bit 3	14		14	47	47	PC#1 Bit 3
		31		31		PC#1 Bit 4
PC#2 Bit 5	15		15	48	48	PC#1 Bit 5
PC#2 Bit 7		32		32		
PC#2 Bit 6	16		16	49	49	PC#1 Bit 6
		33		33		PC#1 Bit 7
ISO POWER IN	17		17	50	50	ISO Ground IN

CHAPTER 5
OPTO OUT24 CONFIGURATION.

Introduction.

Read Chapter 1 first. This chapter explains how to configure the Opto OUT24 card ready to install in a PC. Detailed instructions are given how to set the address select, the IRQ jumper block and the output driver select jumper block. The settings of the watch dog timer output are also explained.

The OUT24 card will fit into 8 or 16 bit slots.

Configuring The Opto OUT24 Card.

The Opto OUT24 card is ready to plug straight into an PC.
Unless there is Good Reason, do not alter its default setting.

However, due to the large variety of individual PC configurations Opto OUT24 may need adjusting to suit the PC.
The default settings are i/o address 0308Hex, IRQ 7 selected but not enabled, WATCHDOG VIA PA10 disabled- the PA10 line is output- and the WATCH DOG OUTPUT OPTIONS, GOODLO output jumpered to OUT, RESHI output jumpered to BUS. The source cards have the UDN2984 chips installed and the sink cards have ULN2803 chips installed. See Figure 5-1.

The Opto OUT24 requires an external power input to power the output drivers and the isolated side of the Opto couplers. On card power regulation allows the use of external un-regulated power source, input range 17.5 - 35 Volts. The power supply input is reverse polarity protected.

Setting The Opto OUT24 I/O Address.

By referring to the Opto OUT24 card locate the 8 way I/O Address DIP switches at the left hand corner of the card. The

factory set address, 0308H, is set as shown in Figure 5-2. DIP switches determine the Opto OUT24 card i/o base address select, DIP switches 1-7 correspond to the A2-A8 address lines, respectively. DIP switch 8 is not connected.

The Opto OUT24 card can reside at one of 128 base addresses on an 4 byte boundary within the range 0200H-03F8H. The factory set default address is 0308hex.

The i/o addresses that are likely to be good in Figure 5-4. addresses to avoid is given in Figure 5-3. Only if the particular adapter card is present need the relevant address be avoided.

Figure 5-1. Opto OUT24 Card Layout.

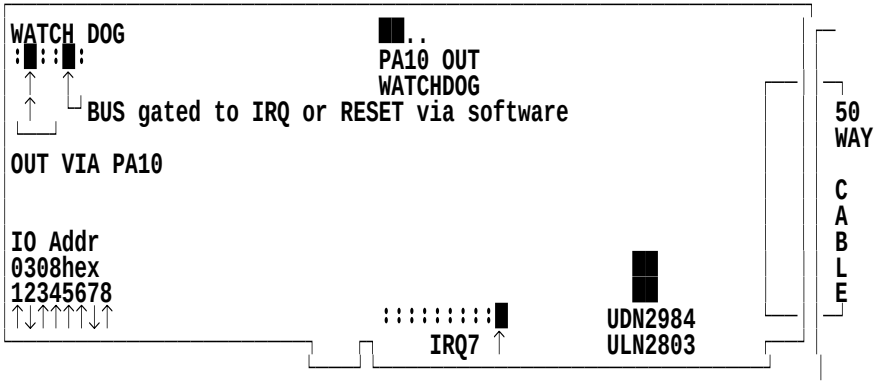
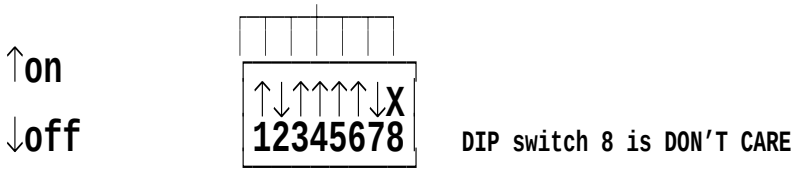


Figure 5-2. Opto Out24 Factory Set DIP Switches.



Opto OUT24 Factory Set Default Address= 0308 Hex, 776 Decimal

Figure 5-4. I/O Addresses To Avoid.

I/O ADDRESS		NORMAL USE.
0201H-	0201H	Game Control Adapter
0278H-	027FH	*** Second Printer Port Adapter
02E1H		*** PC ELITE IEEE Card.
02E1H		IBM/ National Instruments IEEE card.
02F8H-	02FFH	*** COM2 Serial Port
0300H-	031FH	NE2000 Network Card.
0300H-	030FH	3COM Network Card.
0300H-	0307H	*** PC Proto card
0300H-	0303H	*** PC IEEE Card
0300H-	0303H	*** PC DIO24 Card
0308H-	030BH	*** PC Opto OUT24 Card
0308H-	030FH	*** Opto OUT48, Opto DIO16, OptoDIO48 & DIO48 Cards
030CH-	030FH	*** PC Opto IN24 Card
0310H-	031FH	*** PC Timer-DIO Card
0340H-	0360H	*** PC DIO192 Card
0378H-	037FH	*** Printer Port Adapter
03B0H-	03DFH	VGA /SVGA card
03F0H-	03F7H	Floppy Disk Drive Drive.
03F8H-	03FFH	*** COM1 Serial Port.

*** These cards available from us.

Figure 5-4. Likely I/O Address.

I/O ADDRESS		NORMAL USE.
0204H-	0277H	Unused.
0280H-	02BFH	Unused.
02C8H-	02DFH	Unused.
02E4H-	02F7H	Unused.
0300H-	031FH	Unused.
0330H-	035FH	Unused.
0380H-	03AFH	Unused Usually.
03E0H-	03EFH	Unused.

Figure 5-5. Opto OUT24 Base Addresses.

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	Base Address 3FC-380
Off	Off	Off	Off	Off	Off	Off	03FC Hex 1020 Dec
On	Off	Off	Off	Off	Off	Off	03F8 Hex 1016 Dec
Off	On	Off	Off	Off	Off	Off	03F4 Hex 1012 Dec
On	On	Off	Off	Off	Off	Off	03F0 Hex 1008 Dec
Off	Off	On	Off	Off	Off	Off	03EC Hex 1004 Dec

On	Off	On	Off	Off	Off	Off	03E8 Hex	100 Dec
Off	On	On	Off	Off	Off	Off	03E4 Hex	996 Dec
On	On	On	Off	Off	Off	Off	03E0 Hex	992 Dec
Off	Off	Off	On	Off	Off	Off	03DC Hex	988 Dec
On	Off	Off	On	Off	Off	Off	03D8 Hex	984 Dec
Off	On	Off	On	Off	Off	Off	03D4 Hex	980 Dec
On	On	Off	On	Off	Off	Off	03D0 Hex	976 Dec
Off	Off	On	On	Off	Off	Off	03CC Hex	972 Dec
On	Off	On	On	Off	Off	Off	03C8 Hex	968 Dec
Off	On	On	On	Off	Off	Off	03C4 Hex	964 Dec
On	On	On	On	Off	Off	Off	03C0 Hex	960 Dec
Off	Off	Off	Off	On	Off	Off	03BC Hex	956 Dec
On	Off	Off	Off	On	Off	Off	03B8 Hex	952 Dec
Off	On	Off	Off	On	Off	Off	03B4 Hex	948 Dec
On	On	Off	Off	On	Off	Off	03B0 Hex	944 Dec
Off	Off	On	Off	On	Off	Off	03AC Hex	940 Dec
On	Off	On	Off	On	Off	Off	03A8 Hex	936 Dec
Off	On	On	Off	On	Off	Off	03A4 Hex	932 Dec
On	On	On	Off	On	Off	Off	03A0 Hex	928 Dec
Off	Off	Off	On	On	Off	Off	039C Hex	924 Dec
On	Off	Off	On	On	Off	Off	0398 Hex	920 Dec
Off	On	Off	On	On	Off	Off	0394 Hex	916 Dec
On	On	Off	On	On	Off	Off	0390 Hex	912 Dec
Off	Off	On	On	On	Off	Off	038C Hex	908 Dec
On	Off	On	On	On	Off	Off	0388 Hex	904 Dec
Off	On	On	On	On	Off	Off	0384 Hex	900 Dec
On	On	On	On	On	Off	Off	0380 Hex	896 Dec

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	Base Address 378-300	
Off	Off	Off	Off	Off	On	Off	037C Hex	892 Dec
On	Off	Off	Off	Off	On	Off	0378 Hex	888 Dec
Off	On	Off	Off	Off	On	Off	0374 Hex	884 Dec
On	On	Off	Off	Off	On	Off	0370 Hex	880 Dec
Off	Off	On	Off	Off	On	Off	036C Hex	876 Dec
On	Off	On	Off	Off	On	Off	0368 Hex	872 Dec
Off	On	On	Off	Off	On	Off	0364 Hex	868 Dec
On	On	On	Off	Off	On	Off	0360 Hex	864 Dec
Off	Off	Off	On	Off	On	Off	035C Hex	860 Dec
On	Off	Off	On	Off	On	Off	0358 Hex	856 Dec
Off	On	Off	On	Off	On	Off	0354 Hex	852 Dec
On	On	Off	On	Off	On	Off	0350 Hex	848 Dec

Off	Off	On	On	Off	On	Off	034C Hex	844 Dec
On	Off	On	On	Off	On	Off	0348 Hex	840 Dec
Off	On	On	On	Off	On	Off	0344 Hex	836 Dec
On	On	On	On	Off	On	Off	0340 Hex	832 Dec
Off	Off	Off	Off	On	On	Off	033C Hex	828 Dec
On	Off	Off	Off	On	On	Off	0338 Hex	824 Dec
Off	On	Off	Off	On	On	Off	0334 Hex	820 Dec
On	On	Off	Off	On	On	Off	0330 Hex	816 Dec
Off	Off	On	Off	On	On	Off	032C Hex	812 Dec
On	Off	On	Off	On	On	Off	0328 Hex	808 Dec
Off	On	On	Off	On	On	Off	0324 Hex	804 Dec
On	On	On	Off	On	On	Off	0320 Hex	800 Dec
Off	Off	Off	On	On	On	Off	031C Hex	796 Dec
On	Off	Off	On	On	On	Off	0318 Hex	792 Dec
Off	On	Off	On	On	On	Off	0314 Hex	788 Dec
On	On	Off	On	On	On	Off	0310 Hex	784 Dec
Off	Off	On	On	On	On	Off	030C Hex	780 Dec
On	Off	On	On	On	On	Off	0308 Hex	776 Deflt
Off	On	On	On	On	On	Off	0304 Hex	772 Dec
On	On	On	On	On	On	Off	0300 Hex	768 Dec

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	I/O Address 2FC-280	
Off	Off	Off	Off	Off	Off	On	02FC Hex	764 Dec
On	Off	Off	Off	Off	Off	On	02F8 Hex	760 Dec
Off	On	Off	Off	Off	Off	On	02F4 Hex	756 Dec
On	On	Off	Off	Off	Off	On	02F0 Hex	752 Dec
Off	Off	On	Off	Off	Off	On	02EC Hex	748 Dec
On	Off	On	Off	Off	Off	On	02E8 Hex	744 Dec
Off	On	On	Off	Off	Off	On	02E4 Hex	740 Dec
On	On	On	Off	Off	Off	On	02E0 Hex	736 Dec
Off	Off	Off	On	Off	Off	On	02DC Hex	732 Dec
On	Off	Off	On	Off	Off	On	02D8 Hex	728 Dec
Off	On	Off	On	Off	Off	On	02D4 Hex	724 Dec
On	On	Off	On	Off	Off	On	02D0 Hex	720 Dec
Off	Off	On	On	Off	Off	On	02CC Hex	716 Dec
On	Off	On	On	Off	Off	On	02C8 Hex	712 Dec
Off	On	On	On	Off	Off	On	02C4 Hex	708 Dec
On	On	On	On	Off	Off	On	02C0 Hex	704 Dec
Off	Off	Off	Off	On	Off	On	02BC Hex	700 Dec
On	Off	Off	Off	On	Off	On	02B8 Hex	696 Dec
Off	On	Off	Off	On	Off	On	02B4 Hex	692 Dec
On	On	Off	Off	On	Off	On	02B0 Hex	688 Dec

Off	Off	On	Off	On	Off	On	02AC Hex	684 Dec
On	Off	On	Off	On	Off	On	02A8 Hex	680 Dec
Off	On	On	Off	On	Off	On	02A4 Hex	676 Dec
On	On	On	Off	On	Off	On	02A0 Hex	672 Dec
Off	Off	Off	On	On	Off	On	029C Hex	668 Dec
On	Off	Off	On	On	Off	On	0298 Hex	664 Dec
Off	On	Off	On	On	Off	On	0294 Hex	660 Dec
On	On	Off	On	On	Off	On	0290 Hex	656 Dec
Off	Off	On	On	On	Off	On	028C Hex	652 Dec
On	Off	On	On	On	Off	On	0288 Hex	648 Dec
Off	On	On	On	On	Off	On	0284 Hex	644 Dec
On	On	On	On	On	Off	On	0280 Hex	640 Dec

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	Base Address 278-200	
Off	Off	Off	Off	Off	On	On	027C Hex	636 Dec
On	Off	Off	Off	Off	On	On	0278 Hex	632 Dec
Off	On	Off	Off	Off	On	On	0274 Hex	628 Dec
On	On	Off	Off	Off	On	On	0270 Hex	624 Dec
Off	Off	On	Off	Off	On	On	026C Hex	620 Dec
On	Off	On	Off	Off	On	On	0268 Hex	616 Dec
Off	On	On	Off	Off	On	On	0264 Hex	612 Dec
On	On	On	Off	Off	On	On	0260 Hex	608 Dec
Off	Off	Off	On	Off	On	On	025C Hex	604 Dec
On	Off	Off	On	Off	On	On	0258 Hex	600 Dec
Off	On	Off	On	Off	On	On	0254 Hex	596 Dec
On	On	Off	On	Off	On	On	0250 Hex	592 Dec
Off	Off	On	On	Off	On	On	024C Hex	588 Dec
On	Off	On	On	Off	On	On	0248 Hex	584 Dec
Off	On	On	On	Off	On	On	0244 Hex	580 Dec
On	On	On	On	Off	On	On	0240 Hex	576 Dec
Off	Off	Off	Off	On	On	On	023C Hex	572 Dec
On	Off	Off	Off	On	On	On	0238 Hex	568 Dec
Off	On	Off	Off	On	On	On	0234 Hex	564 Dec
On	On	Off	Off	On	On	On	0230 Hex	560 Dec
Off	Off	On	Off	On	On	On	022C Hex	556 Dec
On	Off	On	Off	On	On	On	0228 Hex	552 Dec
Off	On	On	Off	On	On	On	0224 Hex	548 Dec
On	On	On	Off	On	On	On	0220 Hex	544 Dec
Off	Off	Off	On	On	On	On	021C Hex	540 Dec
On	Off	Off	On	On	On	On	0218 Hex	536 Dec
Off	On	Off	On	On	On	On	0214 Hex	532 Dec
On	On	Off	On	On	On	On	0210 Hex	528 Dec

Off	Off	On	On	On	On	On	020C Hex	524 Dec
On	Off	On	On	On	On	On	0208 Hex	520 Dec
Off	On	On	On	On	On	On	0204 Hex	516 Dec
On	On	On	On	On	On	On	0200 Hex	512 Dec

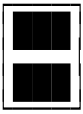
Using More Than One Opto OUT24 Card.

Several Opto DIO cards can be installed at the same time, allowing each card to control its own set of i/o lines.

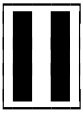
The golden rule is:- Ensure that each card is set to a different i/o address and the ranges do not overlap!

Figure 5-6. Driver Chip Select.

FACTORY SET



UDN2984 Source Drivers Selected — RN14, 16 and 18 installed 10K resistor networks



ULN2804 Sink Drivers Selected — Remove RN14, 16 and 18

UDN2984 ULN2804 Driver Selection.

The card can be configured to use one of two types of high voltage drive chips ULN2804 or UDN 2984 chips. Chapter 1 explains the difference and function of these two driver types.

The two jumper pins directly below and just to the left of the driver chips is used to made the selection.

Source Driver Output Connection.

UDN2984 Drivers.

The UDN2984 chips are high voltage, high current SOURCE drivers, output voltage range 35 to 80 Volts, these could be directly replaced by UDN2981 drivers for output voltages in the

range 5 to 50 Volts. Whilst the 2984/81 drivers have built in output transient suppression diodes, extra diodes are provided on card the Opto OUT24 card for extra protection. The socketed 10k resistor networks RN14, 16 and 18 should be left installed.
For normal operation, with UDN2984 chips installed, sockets U30, U28 and U26 contain non inverting buffers chips 74LS541.
For inverse operation, inverting buffers chips 74LS540 should be installed in sockets U30, U28 and U26.

Sink Driver Output Connection.

ULN2804 Drivers.

The ULN2804 chips are high voltage, high current NPN DARLINGTON drivers, output voltage range to 50 Volts, these could be directly replaced by ULN2824 chips for output voltages up to 95 Volts. The 2804 have open collector outputs. When changing from 2984 to 2804 drivers note than the 2804 are INVERTING drivers, thus to produce the same logical output from a bit pattern written to the output port the 74LS541 chips would have to be replaced by the inverting 74LS540 chips. Remove the socketed 10k resistor networks RN14, 16 & 18.
For inverse operation, then the non inverting buffers chips 74LS541 should be installed in sockets U30, U28 and U26.

Interrupt Selection.

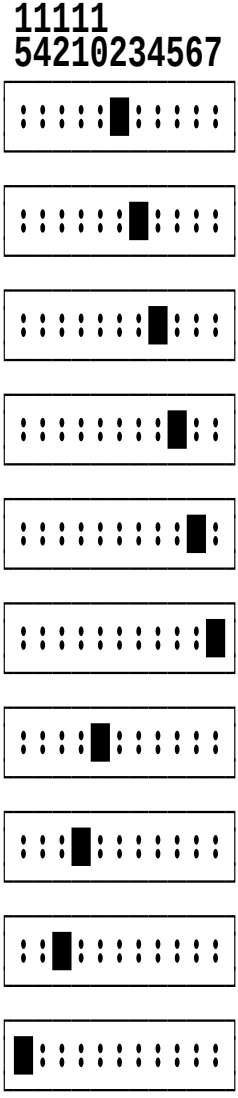
The Opto OUT24 card can produce interrupts from low to high transitions on Watch Dog timeout.

The IRQ must be ENABLED in software AND the IRQ jumper must both be set before any IRQ requests are generated. Thus IRQs can be enabled under program control to suit the changing needs of the application. The position of the jumper MUST match the IRQ level set in the software.

The IRQ enable bits in the watch dog register selects which Opto OUT24 signal generates the interrupt, the IRQ jumper block selects which PC interrupt line is asserted, and so which software interrupt service routine is called. Write your

IRQ service routine to patch the appropriate software interrupt.

Figure 5-7. The IRQ Jumper Block.

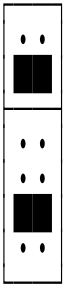

11111
54210234567
NORMAL USE OF INTERRUPT.
IRQ2 EGA/VGA GRAPHICS CARD, Usually Free
Used by only very few graphics cards.
IRQ3 COM 2- COM 8.
IRQ4 COM 1.
IRQ5 PRINTER PORT#2 OK for DOS & Windows
Avoid for OS/2, Windows NT & Novell
IRQ6 FLOPPY DISK DRIVE, AVOID!.
IRQ7 PRINTER PORT#1 OK for DOS & Windows
Avoid for OS/2, Windows NT & Novell
IRQ10 Usually Free
IRQ11 Usually Free
IRQ12 POINTING DEVICE, Usually Free
Free when mouse is on a COM port.
IRQ15 Usually Free

Watch Dog Selection.

Two sets of jumpers, at the lower left side of the card, are used to control the Watch Dog output function, this determines which signals are used to generate an interrupt or reset signal or are to be patched through to the watch dog output. The watch dog enable register is an 8 bit read write register, see Chapter 1.

Figure 5-8. Watchdog Output Select.

FACTORY SET



```
RESLO BUS    Approx 1 microsec LOW pulse on timeout
RESHI BUS    Approx 1 microsec HIGH pulse on timeout

RESHI OUT    Approx 1 microsec HIGH pulse on timeout
RESLO OUT    Approx 1 microsec LOW pulse on timeout
GOODLO OUT   LOW level= not timed out, low 50 milli sec
GOODHI OUT   HIGH level = not timed out, hi 50 milli sec
```

BUS Jumpers.

The top two jumpers, are the BUS jumpers, determine which pulse is gated onto the PC expansion BUS slots interrupt and reset lines. To actually drive the PC's irq and reset lines the lines must be gated on, under program control, by setting bit 0 for the Reset and bit 1 for the Irq line in the watchdog register.

OUT Jumpers.

The lower four jumpers are the OUT jumpers determining which signal may be output on the PA10 line. To actually output this signal the PA10 out jumper must also be set.

OUT Via PA10 Jumpers.

The four pin jumper block at the upper left of the card determines which signal is output, via an Opto isolator, on the PA10 line. Either the PA10 line or the signal selected by the Watch Dog OUT jumper may be routed to the edge connector.

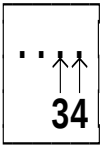
Note when using the INVERTING ULN2804 SINK DRIVERS the Watch Dog signal is also inverted by these drivers, thus the RESHI/LO and GOODHI/LO legends are the inverted.

Figure 5-9. Watchdog Output Select.

FACTORY SET

PORT A1 Bit 0 Output. Via Pin 34 of 50D, pin 1 of 50IDC.

WatchDog Out Signal Output. Via Pin 34 of 50D, pin1 of 50IDC.



WatchDog Out Signal Output. Attach flylead for use inside PC
Pin 3 = Watch dog signal NOT OPTICALLY ISOLATED
Pin 4 = PC ground NOT OPTICALLY ISOLATED

Opto OUT24 Memory Map.

The Opto OUT24 has 24 dedicated output lines arranged as 3 eight bit read/write registers and one read/write watchdog enable/strobe register. Thus the Opto OUT24 card occupies 4 consecutive i/o addresses. See Figure 5-10. The output ports are output only, however the output registers are read/write, writing to them sets the level of the output lines, reading them provides a read back of the previously written value. On power up, all the output lines are reset to zero, low, ie the output drivers are off.

Outputting data to the Port A, B and C registers sets the external output line either high or low. Inputting from the ports returns the previously set value. Writes to the watchdog register gate the signal selected by the BUS jumper onto IRQ line or RESET line of the PC. Reading the watchdog register refreshes the timer and postpones timeout for another 50milliseconds.

Figure 5-10. Opto OUT24 Memory Map.

BASE ADDRESS OFFSET	DEFAULT ADDRESS	DEFAULT ADDRESS	DIO PORT	REGISTER SELECTED
0000 WRITE	0308 Hex	776 Dec	PORT 1	PORT A#1 OUTPUT PORT A
0001 WRITE	0309 Hex	777 Dec	PORT 2	PORT B#1 OUTPUT PORT B
0002 WRITE	030A Hex	778 Dec	PORT 3	PORT C#11OUTPUT PORT C
0003 R/W	030B Hex	779 Dec	PORT 4	WATCH DOG ENABLE REG READ TO REFRESH WATCHDOG
NOTE: ON RESET ALL OUTPUTS ARE SET TO ZERO, =LOW, =OUTPUTS OFF				

Opto OUT24 Output Specification.

Number Of Port Output Lines..... 24
External Power Voltage Range.....17.5 -35 Volts
Ext Power Supply Reverse Polarity Connection Protected.
Maximum External Power Current
All Outputs High Shorted To All Inputs.....1000 mA @ 24V
WHEN SOURCE DRIVER UDN2984 FITTED
Output Voltage.....0 - 35 Volts
Can with stand Maximum OFF Voltage.....80 Volts
Sustained Simultaneous O/put Current all lines.....50mA @35V
Max Output Current per 8 line package.....500mA
Peak Output Current any one line.....350mA
WHEN SINK DRIVER ULN2804 FITTED
Output Voltage.....6 - 35 Volts
Sustained Simultaneous Output Current on all lines.....375mA
Max Output Current per 8 line package.....3A
Peak Output Current any one line.....500mA
PC Power Requirements.....125 mA at 5 Volts
Optical Isolation..... +/- 2500 Volts
Length x Height Of Card..... 7.5 x 4.2 inch.

Opto OUT24 Pinouts.

The OUT24 card has either a 50 way IDC or a 50 pin D connector. The 50 way IDC connector has two rows of 25 pins

on a 0.1 inch pitch. The 50 way D connector has three rows of 17, 16, 17 pins, on a 2.75 mm pitch.

Figure 5-11. Opto OUT24 J2 Pin Outs.

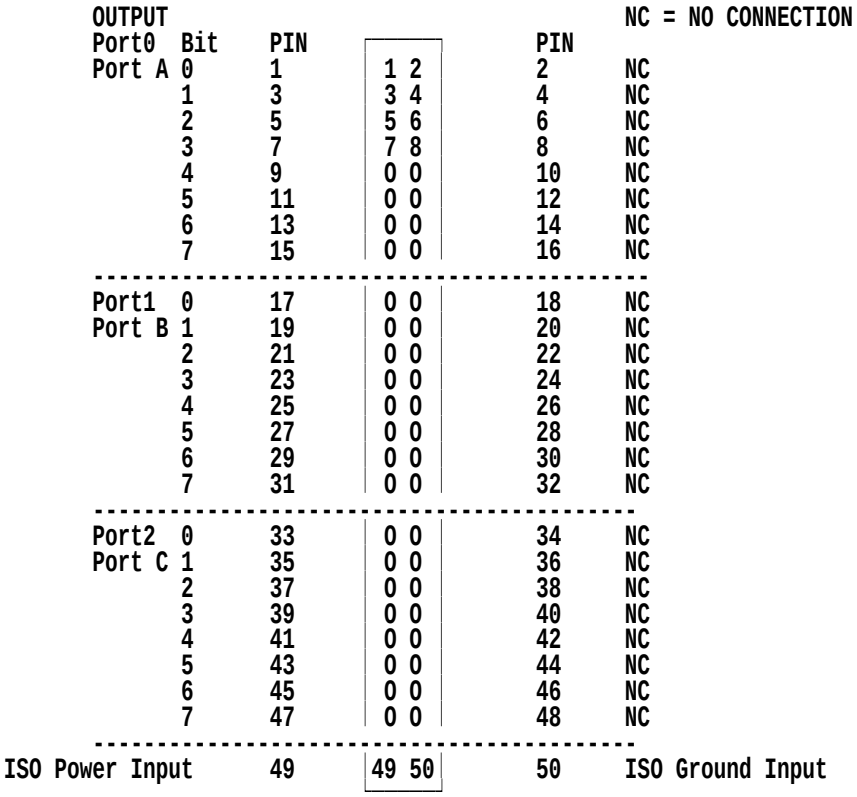
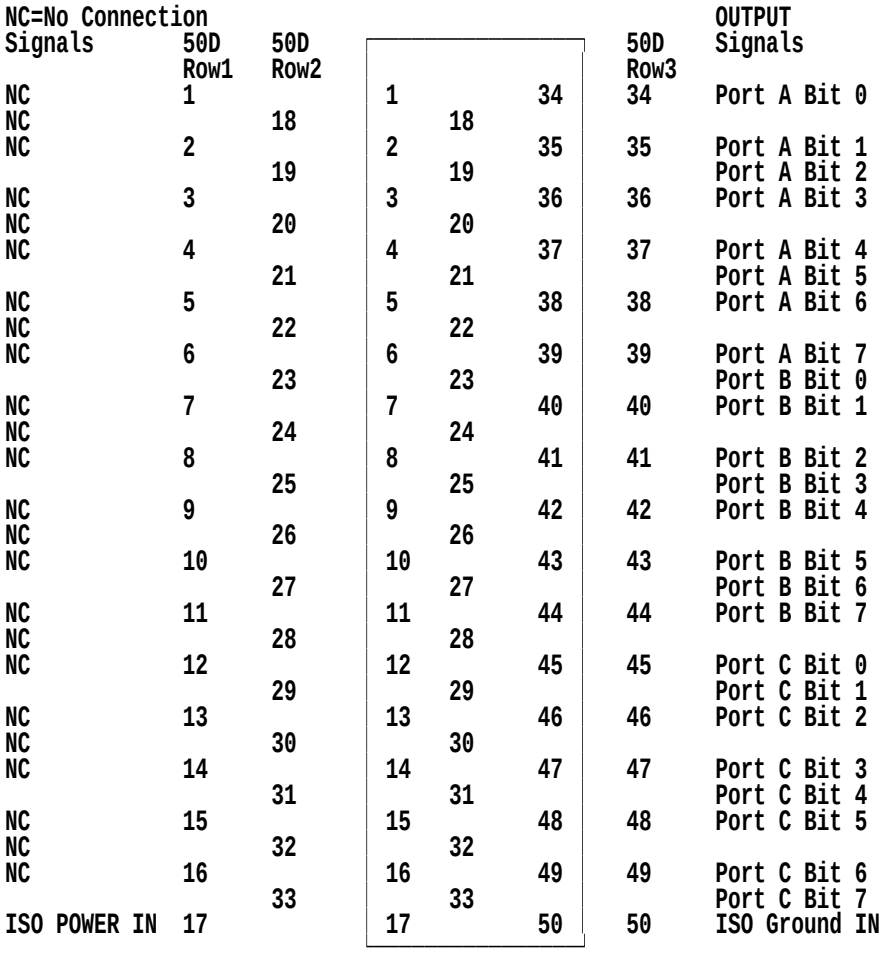


Figure 5-12. Opto OUT24 J2 Female 50D Pinout.



NC=No Connection Signals	50D Row1	50D Row2				50D Row3	OUTPUT Signals
NC	1		1		34	34	Port A Bit 0
NC		18		18			
NC	2		2		35	35	Port A Bit 1
		19		19			Port A Bit 2
NC	3		3		36	36	Port A Bit 3
NC		20		20			
NC	4		4		37	37	Port A Bit 4
		21		21			Port A Bit 5
NC	5		5		38	38	Port A Bit 6
NC		22		22			
NC	6		6		39	39	Port A Bit 7
		23		23			Port B Bit 0
NC	7		7		40	40	Port B Bit 1
NC		24		24			
NC	8		8		41	41	Port B Bit 2
		25		25			Port B Bit 3
NC	9		9		42	42	Port B Bit 4
NC		26		26			
NC	10		10		43	43	Port B Bit 5
		27		27			Port B Bit 6
NC	11		11		44	44	Port B Bit 7
NC		28		28			
NC	12		12		45	45	Port C Bit 0
		29		29			Port C Bit 1
NC	13		13		46	46	Port C Bit 2
NC		30		30			
NC	14		14		47	47	Port C Bit 3
		31		31			Port C Bit 4
NC	15		15		48	48	Port C Bit 5
NC		32		32			
NC	16		16		49	49	Port C Bit 6
		33		33			Port C Bit 7
ISO POWER IN	17		17		50	50	ISO Ground IN

CHAPTER 6
Opto IN24 CONFIGURATION

Introduction.

Read Chapter 1 first. This chapter explains how to configure the Opto IN24 card ready to install in a PC. Detailed instructions are given how to set the address select, the IRQ jumper block and the output driver select jumper block. The settings of the watch dog timer output are also explained.

The IN24 card will fit into 8 or 16 bit slots.

Configuring The Opto IN24 Card.

The Opto IN24 card is ready to plug straight into an PC.
Unless there is Good Reason, do not alter its default setting.

However, due to the large variety of individual PC configurations Opto IN24 may need adjusting to suit the PC.
The default settings are i/o address 030CHex, IRQ 7 selected but not enabled, and the Watch Dog output options, RESHI output jumpered to BUS. Whetting voltage disabled. See Figure 6-1.

The Opto IN24 does not require any external power.

Setting The Opto IN24 I/O Address.

By referring to the Opto IN24 card locate the 8 way I/O Address DIP switches at the left hand corner of the card. The factory set address, 030CH, is set as shown in Figure 6-2. DIP switches determine the Opto IN24 card i/o base address select, DIP switches 1-7 correspond to the A2-A8 address lines, respectively. DIP switch 8 is not connected.

The Opto IN24 card can reside at one of 128 base addresses on an 4 byte boundary within the range 0200H-03F8H. The factory set default address is 030Chex.

The i/o addresses that are likely to be good in Figure 6-3. addresses to avoid is given in Figure 6-4. Only if the particular adapter card is present need the relevant address be avoided.

Figure 6-1. PC Opto IN24 Card Layout.

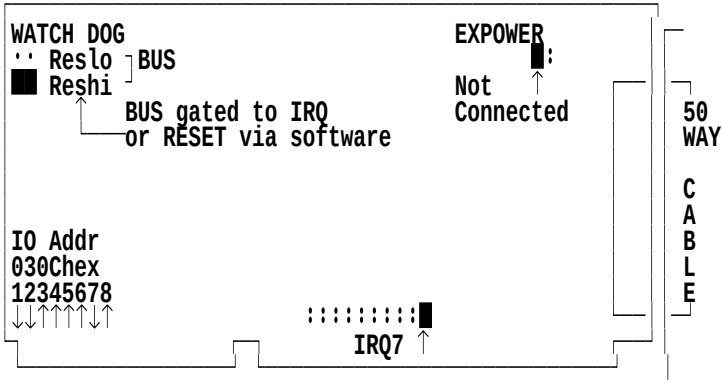
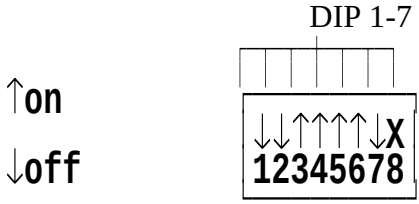


Figure 6-2. Opto IN24 Factory Set DIP Switches.



PC Opto IN24 Factory Set Default Address= 030C Hex, 776 Decimal

Figure 6-3. Likely I/O Address.

I/O ADDRESS	NORMAL USE.
0204H- 0277H	Unused.
0280H- 02BFH	Unused.
02C8H- 02DFH	Unused.
02E4H- 02F7H	Unused.
0300H- 031FH	Unused.
0330H- 035FH	Unused.
0380H- 03AFH	Unused Usually.
03E0H- 03EFH	Unused.

Figure 6-4. I/O Addresses To Avoid.

I/O ADDRESS	NORMAL USE.
0201H-	0201H Game Control Adapter
0278H-	027FH *** Second Printer Port Adapter
02E1H	*** PC ELITE IEEE Card.
02E1H	IBM/ National Instruments IEEE card.
02F8H-	02FFH *** COM2 Serial Port
0300H-	031FH NE2000 Network Card.
0300H-	030FH 3COM Network Card.
0300H-	0307H *** PC Proto card
0300H-	0303H *** PC IEEE Card
0300H-	0303H *** PC DIO24 Card
0308H-	030BH *** PC Opto OUT24 Card
0308H-	030FH *** Opto OUT48, Opto DIO16, OptoDIO48 & DIO48 Cards
030CH-	030FH *** PC Opto IN24 Card
0310H-	031FH *** PC Timer-DIO Card
0340H-	0360H *** PC DIO192 Card
0378H-	037FH *** Printer Port Adapter
03B0H-	03DFH VGA /SVGA card
03F0H-	03F7H Floppy Disk Drive Drive.
03F8H-	03FFH *** COM1 Serial Port.

*** These cards available from us.

Figure 6-5. Opto IN24 Base Addresses.

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	Base Address 3FC-380	
Off	Off	Off	Off	Off	Off	Off	03FC Hex	1020 Dec
On	Off	Off	Off	Off	Off	Off	03F8 Hex	1016 Dec
Off	On	Off	Off	Off	Off	Off	03F4 Hex	1012 Dec
On	On	Off	Off	Off	Off	Off	03F0 Hex	1008 Dec
Off	Off	On	Off	Off	Off	Off	03EC Hex	1004 Dec
On	Off	On	Off	Off	Off	Off	03E8 Hex	100 Dec
Off	On	On	Off	Off	Off	Off	03E4 Hex	996 Dec
On	On	On	Off	Off	Off	Off	03E0 Hex	992 Dec
Off	Off	Off	On	Off	Off	Off	03DC Hex	988 Dec
On	Off	Off	On	Off	Off	Off	03D8 Hex	984 Dec
Off	On	Off	On	Off	Off	Off	03D4 Hex	980 Dec
On	On	Off	On	Off	Off	Off	03D0 Hex	976 Dec
Off	Off	On	On	Off	Off	Off	03CC Hex	972 Dec
On	Off	On	On	Off	Off	Off	03C8 Hex	968 Dec
Off	On	On	On	Off	Off	Off	03C4 Hex	964 Dec
On	On	On	On	Off	Off	Off	03C0 Hex	960 Dec
Off	Off	Off	Off	On	Off	Off	03BC Hex	956 Dec
On	Off	Off	Off	On	Off	Off	03B8 Hex	952 Dec

Off	On	Off	Off	On	Off	Off	03B4 Hex	948 Dec
On	On	Off	Off	On	Off	Off	03B0 Hex	944 Dec
Off	Off	On	Off	On	Off	Off	03AC Hex	940 Dec
On	Off	On	Off	On	Off	Off	03A8 Hex	936 Dec
Off	On	On	Off	On	Off	Off	03A4 Hex	932 Dec
On	On	On	Off	On	Off	Off	03A0 Hex	928 Dec
Off	Off	Off	On	On	Off	Off	039C Hex	924 Dec
On	Off	Off	On	On	Off	Off	0398 Hex	920 Dec
Off	On	Off	On	On	Off	Off	0394 Hex	916 Dec
On	On	Off	On	On	Off	Off	0390 Hex	912 Dec
Off	Off	On	On	On	Off	Off	038C Hex	908 Dec
On	Off	On	On	On	Off	Off	0388 Hex	904 Dec
Off	On	On	On	On	Off	Off	0384 Hex	900 Dec
On	On	On	On	On	Off	Off	0380 Hex	896 Dec

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	Base Address 378-300	
Off	Off	Off	Off	Off	On	Off	037C Hex	892 Dec
On	Off	Off	Off	Off	On	Off	0378 Hex	888 Dec
Off	On	Off	Off	Off	On	Off	0374 Hex	884 Dec
On	On	Off	Off	Off	On	Off	0370 Hex	880 Dec
Off	Off	On	Off	Off	On	Off	036C Hex	876 Dec
On	Off	On	Off	Off	On	Off	0368 Hex	872 Dec
Off	On	On	Off	Off	On	Off	0364 Hex	868 Dec
On	On	On	Off	Off	On	Off	0360 Hex	864 Dec
Off	Off	Off	On	Off	On	Off	035C Hex	860 Dec
On	Off	Off	On	Off	On	Off	0358 Hex	856 Dec
Off	On	Off	On	Off	On	Off	0354 Hex	852 Dec
On	On	Off	On	Off	On	Off	0350 Hex	848 Dec
Off	Off	On	On	Off	On	Off	034C Hex	844 Dec
On	Off	On	On	Off	On	Off	0348 Hex	840 Dec
Off	On	On	On	Off	On	Off	0344 Hex	836 Dec
On	On	On	On	Off	On	Off	0340 Hex	832 Dec
Off	Off	Off	Off	On	On	Off	033C Hex	828 Dec
On	Off	Off	Off	On	On	Off	0338 Hex	824 Dec
Off	On	Off	Off	On	On	Off	0334 Hex	820 Dec
On	On	Off	Off	On	On	Off	0330 Hex	816 Dec
Off	Off	On	Off	On	On	Off	032C Hex	812 Dec
On	Off	On	Off	On	On	Off	0328 Hex	808 Dec
Off	On	On	Off	On	On	Off	0324 Hex	804 Dec
On	On	On	Off	On	On	Off	0320 Hex	800 Dec
Off	Off	Off	On	On	On	Off	031C Hex	796 Dec

On	Off	Off	On	On	On	Off	0318 Hex	792 Dec
Off	On	Off	On	On	On	Off	0314 Hex	788 Dec
On	On	Off	On	On	On	Off	0310 Hex	784 Dec
Off	Off	On	On	On	On	Off	030C Hex	780 Deflt
On	Off	On	On	On	On	Off	0308 Hex	776 Dec
Off	On	On	On	On	On	Off	0304 Hex	772 Dec
On	On	On	On	On	On	Off	0300 Hex	768 Dec

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	I/O Address 2FC-280	
Off	Off	Off	Off	Off	Off	On	02FC Hex	764 Dec
On	Off	Off	Off	Off	Off	On	02F8 Hex	760 Dec
Off	On	Off	Off	Off	Off	On	02F4 Hex	756 Dec
On	On	Off	Off	Off	Off	On	02F0 Hex	752 Dec
Off	Off	On	Off	Off	Off	On	02EC Hex	748 Dec
On	Off	On	Off	Off	Off	On	02E8 Hex	744 Dec
Off	On	On	Off	Off	Off	On	02E4 Hex	740 Dec
On	On	On	Off	Off	Off	On	02E0 Hex	736 Dec
Off	Off	Off	On	Off	Off	On	02DC Hex	732 Dec
On	Off	Off	On	Off	Off	On	02D8 Hex	728 Dec
Off	On	Off	On	Off	Off	On	02D4 Hex	724 Dec
On	On	Off	On	Off	Off	On	02D0 Hex	720 Dec
Off	Off	On	On	Off	Off	On	02CC Hex	716 Dec
On	Off	On	On	Off	Off	On	02C8 Hex	712 Dec
Off	On	On	On	Off	Off	On	02C4 Hex	708 Dec
On	On	On	On	Off	Off	On	02C0 Hex	704 Dec
Off	Off	Off	Off	On	Off	On	02BC Hex	700 Dec
On	Off	Off	Off	On	Off	On	02B8 Hex	696 Dec
Off	On	Off	Off	On	Off	On	02B4 Hex	692 Dec
On	On	Off	Off	On	Off	On	02B0 Hex	688 Dec
Off	Off	On	Off	On	Off	On	02AC Hex	684 Dec
On	Off	On	Off	On	Off	On	02A8 Hex	680 Dec
Off	On	On	Off	On	Off	On	02A4 Hex	676 Dec
On	On	On	Off	On	Off	On	02A0 Hex	672 Dec
Off	Off	Off	On	On	Off	On	029C Hex	668 Dec
On	Off	Off	On	On	Off	On	0298 Hex	664 Dec
Off	On	Off	On	On	Off	On	0294 Hex	660 Dec
On	On	Off	On	On	Off	On	0290 Hex	656 Dec
Off	Off	On	On	On	Off	On	028C Hex	652 Dec
On	Off	On	On	On	Off	On	0288 Hex	648 Dec
Off	On	On	On	On	Off	On	0284 Hex	644 Dec
On	On	On	On	On	Off	On	0280 Hex	640 Dec

DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	Base Address 278-200	
Off	Off	Off	Off	Off	On	On	027C Hex	636 Dec
On	Off	Off	Off	Off	On	On	0278 Hex	632 Dec
Off	On	Off	Off	Off	On	On	0274 Hex	628 Dec
On	On	Off	Off	Off	On	On	0270 Hex	624 Dec
Off	Off	On	Off	Off	On	On	026C Hex	620 Dec
On	Off	On	Off	Off	On	On	0268 Hex	616 Dec
Off	On	On	Off	Off	On	On	0264 Hex	612 Dec
On	On	On	Off	Off	On	On	0260 Hex	608 Dec
Off	Off	Off	On	Off	On	On	025C Hex	604 Dec
On	Off	Off	On	Off	On	On	0258 Hex	600 Dec
Off	On	Off	On	Off	On	On	0254 Hex	596 Dec
On	On	Off	On	Off	On	On	0250 Hex	592 Dec
Off	Off	On	On	Off	On	On	024C Hex	588 Dec
On	Off	On	On	Off	On	On	0248 Hex	584 Dec
Off	On	On	On	Off	On	On	0244 Hex	580 Dec
On	On	On	On	Off	On	On	0240 Hex	576 Dec
Off	Off	Off	Off	On	On	On	023C Hex	572 Dec
On	Off	Off	Off	On	On	On	0238 Hex	568 Dec
Off	On	Off	Off	On	On	On	0234 Hex	564 Dec
On	On	Off	Off	On	On	On	0230 Hex	560 Dec
Off	Off	On	Off	On	On	On	022C Hex	556 Dec
On	Off	On	Off	On	On	On	0228 Hex	552 Dec
Off	On	On	Off	On	On	On	0224 Hex	548 Dec
On	On	On	Off	On	On	On	0220 Hex	544 Dec
Off	Off	Off	On	On	On	On	021C Hex	540 Dec
On	Off	Off	On	On	On	On	0218 Hex	536 Dec
Off	On	Off	On	On	On	On	0214 Hex	532 Dec
On	On	Off	On	On	On	On	0210 Hex	528 Dec
Off	Off	On	On	On	On	On	020C Hex	524 Dec
On	Off	On	On	On	On	On	0208 Hex	520 Dec
Off	On	On	On	On	On	On	0204 Hex	516 Dec
On	On	On	On	On	On	On	0200 Hex	512 Dec

Using More Than One Opto IN24 Card.

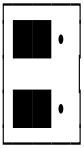
Several Opto DIO cards can be installed at the same time, allowing each card to control its own set of i/o lines.

The golden rule is:- Ensure that each card is set to a different i/o address and the ranges do not overlap!

Volt Free Contact Whetting Voltage.

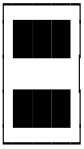
An on card isolated power supply provides 12 volts at 2 Watts as a whetting voltage source for volt free contacts. This isolated 12 Volt source, with it isolated ground, can be drawn out through the edge connector on IDC pins 49 and 50, 50D pins 17 and 50, when the EXPOWER jumpers are set correctly.

Figure 6-6. Expower Jumpers.



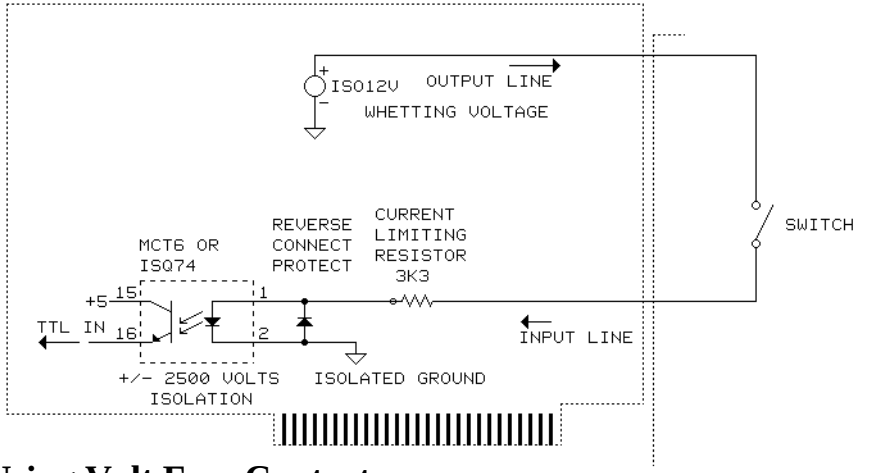
On board ISO +12V power NOT output via edge connector.

FACTORY SET



On board +12V power output via edge connector.

Figure 6-7. Whetting Volt Free Contacts.



Using Volt Free Contacts.

Users often need to know whether a switch has been opened or closed by an operator. Switches, or any other volt free

contacts, do not necessarily have their own power source. So a switch by itself connected to the Opto IN24 card will not drive the input circuitry no matter if it is open or closed. When the ISO+12 volts is taken from the IN24 card, passed through the switch and then back to the input port pin a current can flow when the switch is closed. The current is limited by the 3k3 Ohm resistor on board the IN24 and so no more than 12 Volts/3300 Ohms = 3.6 milli amps is drawn. The power used is W= VI= 44 milli Watts. Thus if all 24 inputs are driven by the isolated +12 whetting voltage the total power consumed would be 1.047 Watts. This is about half the capacity the on board converter can supply.

Interrupt Selection.

The Opto IN24 card can produce interrupts from low to high transitions on three signal lines, Watch Dog timeout, Port C2 input bit 0 and Port C2 input bit 3.

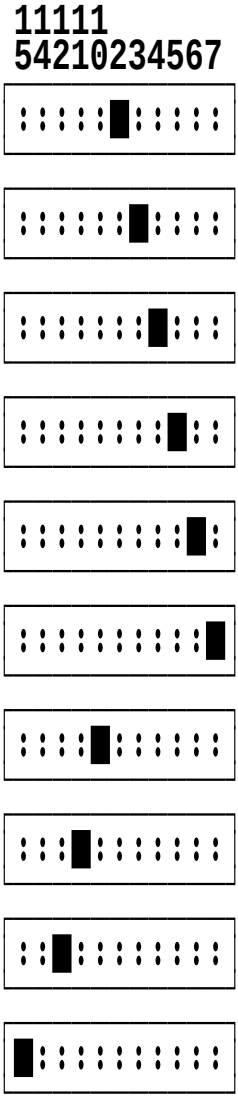
The IRQ must be ENABLED in software AND the IRQ jumper must both be set before any IRQ requests are generated. Thus IRQs can be enabled under program control to suit the changing needs of the application. The position of the jumper MUST match the IRQ level set in the software.

The IRQ enable bits in the watch dog register selects which Opto IN24 signal generates the interrupt, the IRQ jumper block selects which PC interrupt line is asserted, and so which software interrupt service routine is called. Write your IRQ service routine to patch the appropriate software interrupt.

Watch Dog Selection.

One set of jumpers, at the upper left side of the card, are used to control the Watch Dog output function, this determines which signal is used to generate an interrupt or reset signal. The watch dog enable register is an 8 bit read write register, see Chapter 1.

Figure 6-8. The IRQ Jumper Block.



NORMAL USE OF INTERRUPT.

IRQ2 EGA/VGA GRAPHICS CARD, Usually Free
Used by only very few graphics cards.

IRQ3 COM 2- COM 8.

IRQ4 COM 1.

IRQ5 PRINTER PORT#2 OK for DOS & Windows
Avoid for OS/2, Windows NT & Novell

IRQ6 FLOPPY DISK DRIVE, AVOID!.

IRQ7 PRINTER PORT#1 OK for DOS & Windows
Avoid for OS/2, Windows NT & Novell

IRQ10 Usually Free

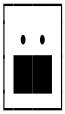
IRQ11 Usually Free

IRQ12 POINTING DEVICE, Usually Free
Free when mouse is on a COM port.

IRQ15 Usually Free

Figure 6-9. Watchdog Output Select.

FACTORY SET



RESLO BUS	**Approx 1 microsec LOW pulse on timeout**
RESHI BUS	**Approx 1 microsec HIGH pulse on timeout**

BUS Jumpers.

The top two jumpers, are the BUS jumpers, determine which pulse is gated onto the PC expansion BUS slots interrupt and reset lines. To actually drive the PC's irq and reset lines the lines must be gated on, under program control, by setting bit 0 for the Reset and bit 1 for the Irq line in the watchdog register.

Opto IN24 Memory Map.

The Opto OUT24 has 24 dedicated input lines arranged as 3 eight bit read only registers and one read/write watchdog enable/strobe register. Thus the Opto IN24 card occupies 4 consecutive i/o addresses, the base address plus 3 other addresses. See Figure 6-10

The exact I/O base address is set by the DIP switches on the card, see above. Inputting data from the Port A, B and C registers senses the values of the pins at the external connector. Writes to the watchdog register gate the Port C bit 0 and Bit 3 input signals and the signal selected by the BUS jumper to be gated onto IRQ line or RESET line of the PC. Reading the watchdog register refreshes the timer and postpones timeout for another 50milliseconds.

Figure 6-10. Opto In24 Memory Map.

BASE ADDRESS OFFSET	DEFAULT ADDRESS	DEFAULT ADDRESS	IN24 PORT	REGISTER SELECTED
0000 READ	030C Hex	780 Dec	PORT 0	PORT A INPUT PORT A
0001 READ	030D Hex	781 Dec	PORT 1	PORT B INPUT PORT B
0002 READ	030E Hex	782 Dec	PORT 2	PORT C INPUT PORT C
0003 R/W	030F Hex	783 Dec	PORT 3	WATCH DOG ENABLE REG READ TO REFRESH WATCHDOG

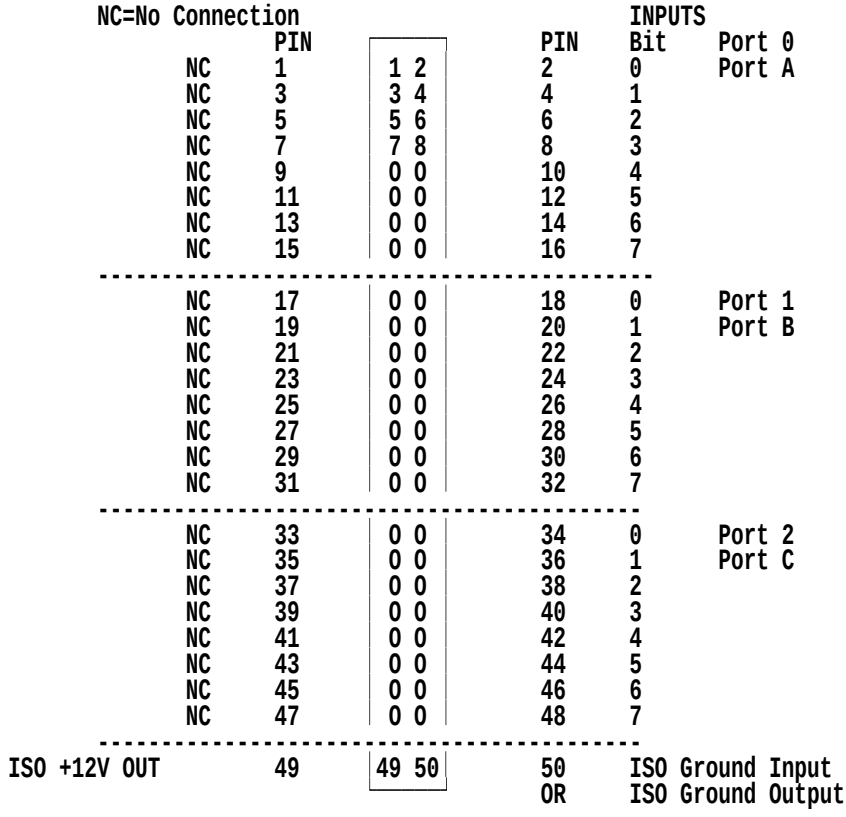
Opto IN24 Input Specification.

Number Of Port Input Lines..... 24
Input Logic level HIGH..... 2.4 - 24.0 Volts
Input Logic level LOW..... 0.0 - 2.38 Volts
Absolute Maximum Input Voltage..... 35 Volts
Maximum Input Current One In Line High..... 7.25 mA at 24V
Maximum Input Current All In Lines High..... 175 mA at 24V
PC Power Requirements..... 80 mA at 5V
Optical Isolation..... +/- 2500 Volts
Length x Height Of Card..... 6.2 x 4.2 inch.
All Inputs Reverse Polarity Connection Protected.

Opto IN24 Pinouts.

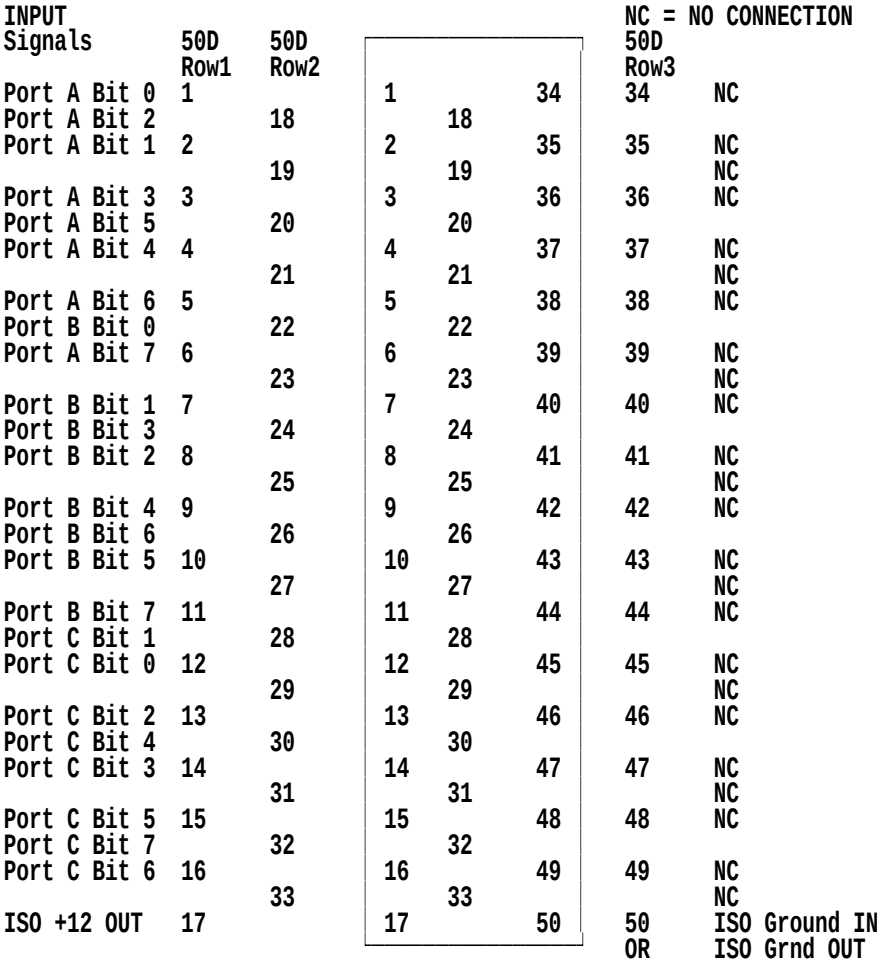
The IN24 card has either a 50 way IDC or a 50 pin D connector. The 50 way IDC connector has two rows of 25 pins on a 0.1 inch pitch. The 50 way D connector has three rows of 17, 16, 17 pins, on a 2.75 mm pitch.

Figure 6-11. Opto IN24 J2 Pin Outs.



NOTE: If the EXPOWER jumpers are set, see Figure 6-6 and Figure 6-7, then the isolated power +12 Volt whetting voltage and its associated isolated ground return path are output to a users external contacts via pins 49 and 50.

Figure 6-12. Opto IN24 J2 Female 50D Pinout.



NOTE: If the EXPOWER jumpers are set, see Figure 6-6 and Figure 6-7, then the isolated power +12 Volt whetting voltage and its associated isolated ground return path are output to a users external contacts via pins 17 and 50.

CHAPTER 7
INSTALLATION.

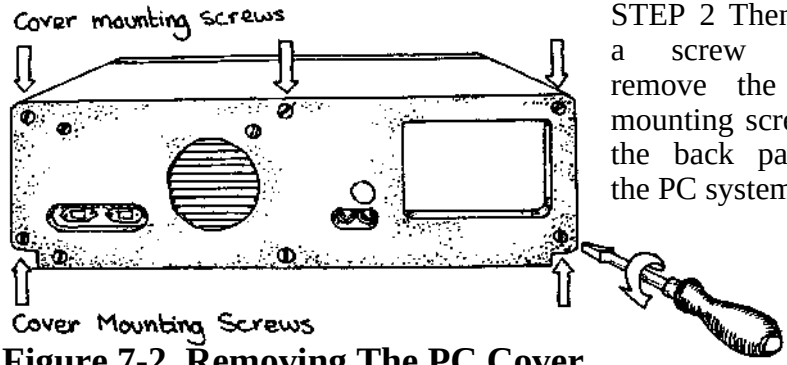
Installing The Opto Board In The Computer.

NOTE: Always turn the computer OFF before installing or removing any interface board..!!!

After having made sure that the i/o address is correctly set, now is the time to insert the Opto board into the i/o connector slots in the computer.

STEP 1 Before the Opto board can be installed the power to the PC MUST be switched OFF!

Figure 7-1. Remove Cover Mounting Screws.



STEP 2 Then using a screw driver, remove the cover mounting screws on the back panel of the PC system unit.

Figure 7-2. Removing The PC Cover.

STEP 3 Next, remove the PC's cover by sliding it forward and up. It usually helps to disconnect the keyboard from the PC since it tends to get in the way when the case is removed.

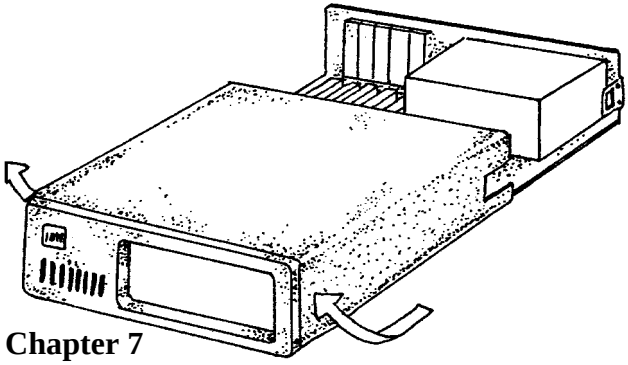
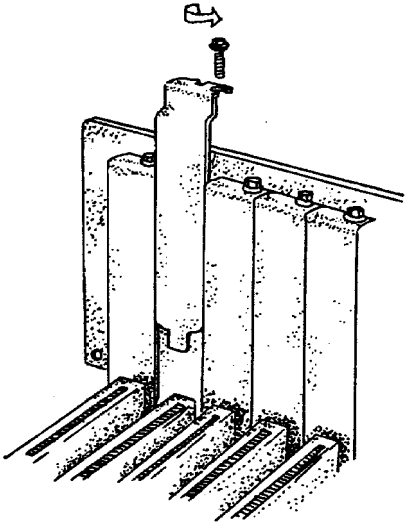
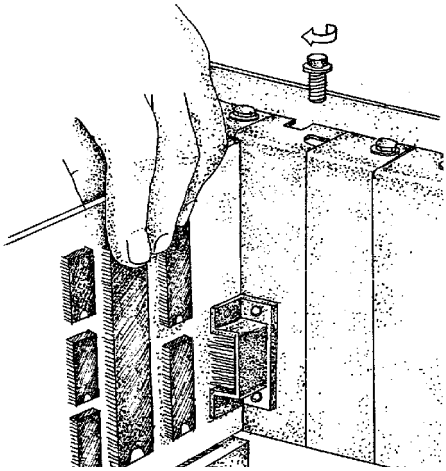


Figure 7-3. Removing Blanking Cover.



STEP 4 Choose an empty expansion slot. The Opto card will fit either a full length or a short slot, a 8 bit PC type slot or a 16 bit AT type slot. In general it is wise to leave the larger slots free for those boards that insist on greater room. Remove the blanking cover protecting the slot on the PC back panel. KEEP the blanking cover screw safely for later.

Figure 7-4. Inserting The Opto Card.



STEP 5 Now insert the Opto card in the slot. Be careful to ensure that the gold plated pcb fingers fits neatly into the i/o expansion connector. Press down firmly but evenly on the top of the Opto card.

STEP 6 The 50 way IDC connector should fit neatly through the slot's aperture to the outside world.

Use the screw kept back from the blanking cover to screw the Opto retaining bracket into the PC back panel housing.

STEP 7 Now replace the system units cover by carefully sliding it down and over the system unit. Replace the cover screws.
STEP 8 After attaching all the monitor and keyboard cables, power up the PC. Do not forget the mains power cable!

The PC should power on in the normal way.

Problems!

If the system fails to power up check the following.

i.) Ensure that the Opto card is installed correctly.
ii.) Ensure that other cards in the PC have not been upset.
iii.) Ensure the power is connected and the PC is switched ON!
iv.) Ensure the Opto card i/o address is set correctly. Defaults are Opto DIO48, Opto DIO16, Opto OUT24 and Opto OUT48 all at 0308h, the Opto IN24 at 030C hex.

If all these have been checked and the PC still does not power up then there is probably a conflict of i/o address between the Opto board and another board in the PC. Ask your dealer to check this or contact the HELP line as given on Intro page 2.

Screw Terminal Board.

The easiest and tidiest way to connect your i/o card to your rig is via the Screw Terminal Board.

The Screw Terminal Board converts from both 50 IDC ribbon or 50D cable to screw terminals. The screw terminals can take wire up to 2.5mm, 0.1 inch diameter. The 50IDC entry is a latching connector, the 50D has screw locks to ensure hold fast connections. The Screw Terminal Board comes complete with a VERO box and removal lid, ready for mounting inside.

Power taken from the PC via the cards PWR=LNK jumper is fed through a removable fuse and LED. Decoupling capacitors are provided.

Each screw terminal, is clearly identified by IDC pin number, and Opto DIO signal name, it can also take an optional LED to show signal logic state. A handy cable grip clamps the wires to ensure a robust, tidy layout. Order one now!

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